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ETHER INHALERS IN EARLY USE

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ON A brick building at 17-19 Tremont Street, Boston, an inconspicuous bronze tablet commemorates the first of two events that served to introduce ether anesthesia and thereby changed the history of surgery. The tablet is inscribed as follows: "On Sept. 30, 1846, in a room in this building, Dr. William Thomas Green Morton first demonstrated the value of ether as an anaesthetic in a dental operation." A little more than two weeks from this date, on October 16, 1846, Morton, a successful dentist of twenty-seven who was also an enrolled student of medicine at Harvard, gave his epochal demonstration of ether as a pain-relieving agent in an operation for a vascular tumor of the neck, performed by Dr. John Collins Warren.

Following this discovery ether inhalers were produced in great variety and number. They included intricate and costly pieces of machinery, as well as mere bladders equipped with an inhaling tube and mouthpiece. The earliest of these inhalers, after Morton's, were brought out in this country, although Morton's instrument remained the only one in general use here. Many of the earliest, if not the most elaborate, ether inhalers in Europe were those produced in England, where the foundations of our modern scientific knowledge of anesthesia were laid through the work of John Snow.

In the dental operation of September 30, 1846, Morton administered ether by means of a saturated handkerchief given to the patient, Eben H. Frost, to inhale when he asked to be mesmerized before the extraction of an ulcerated tooth. During the interval, however, between this highly successful experiment and the operation at the hospital, Morton having applied to Dr. Warren on October 5 for permission to demonstrate his compound, a search was made for a suitable inhaling apparatus. Morton apparently had previously been interested in methods of inhaling, this interest, according to his own statements, dating back to the summer of 1844. At that time, when he was a medical student under Dr. Charles T. Jackson prior to his admission to Harvard, and as a result of Jackson's suggesting ether when he was filling a tooth for a patient, he pored over the ether literature he found in Jackson's library and began his self-experiments with the drug, hoping to prove it an alleviator of pain in dentistry.

Aside from Pereira's *Materia Medica*, there are no specific references concerning Morton's reading at this period, but he might easily have come across such references to ether inhalation as those of Richard Pearson, Thornton and Nysten among others. During the 1830's and early 1840's, moreover, there was a good deal published, including the writings of Scudamore and Corrigan, on the inhalation treatment of diseases of the respiratory tract. Frequently there was some mention, if not a description, of apparatus for the inhalation of iodine, chlorine and other vapors. Above all, any early ideas he may have entertained on the subject of anesthesia in dentistry were greatly strengthened in January, 1845, by his witnessing the demonstration (technically a failure) of nitrous oxide gas by Horace Wells, his former dental instructor and partner.

Late in the summer of 1846, after various experiments, which Morton claimed included some on his dental assistants as well as on animals, had failed to produce any conclusive results and he was "much discouraged," he determined to procure a satisfactory form of apparatus. To this end he had several conferences with Joseph Wightman, maker of philosophical instruments on Cornhill. Morton[1] stated:

> While examining his bags for inhaling nitrous oxide gas, the thought struck me that I could put the ether into one of these, and by making an opening to be closed by a valve, for the admission of atmospheric air, could convert it into an inhaling apparatus. Upon second thought I had an impression that ether would dissolve India rubber, and put the question to Mr. Wightman. He thought it would. I then put the same question as to oil silk.

Wightman, it is said, advised him to get the opinion of a chemist, suggesting that he consult his former preceptor, Dr. Jackson, who was a chemist and geologist of note as well as a physician. This Morton did, and the interview, which was based on certain inquiries concerning ether, provided Jackson with what he regarded as a conclusive argument in favor

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of his own later claim to priority of discovery. At about that time Morton also conferred with N. B. Chamberlain, an instrument maker of School Street, in regard to inhalers.

Dr. Jackson, perhaps recalling Faraday's[2] statement, "A convenient mode of ascertaining the effects is obtained by introducing a tube into the upper part of a bottle containing ether, and breathing through it," had first suggested a simple flask with a glass tube inserted in it. Morton reported that he attempted to employ this device in a self-experiment shortly before his operation on Frost but completed the experiment by inhaling the ether from his handkerchief. Jackson later advised the use of a flask with a bent glass tube 3 feet long, but this proved unsatisfactory and Morton obtained from Wightman a tubulated globe receiver employed in distillation. A piece of sponge moistened with ether was put in the larger end of the globe, and a wooden tube for a mouthpiece was added, the patient's nostrils being compressed between the thumb and finger of the operator or dental assistant.

After this apparatus had been employed for several tooth extractions, with varying degrees of success, Wightman introduced a cork in the tubulure, through which a dropping tube was inserted, notches having been cut in the cork for admission of air and for pouring the ether. But Morton, always speculating on the possibility of asphyxia from the apparatus, was not yet satisfied. His anxiety, in fact, became so great that on the evening before his demonstration at the hospital he consulted Dr. Augustus A. Gould, a member of the Massachusetts Medical Society and one of his most sympathetic and helpful advisers. Dr. Gould suggested the employment of valves to control the flow of air, and together with Morton and Wightman spent the better part of the night making sketches of new apparatus. At daybreak of October 16, Morton took the final design to N. B. Chamberlain and persuaded him to set to work on it. A little before ten o'clock — the hour of his appointment at the hospital — he left Chamberlain's shop carrying a new inhaler, the description of which he[3] later published with the following detail:

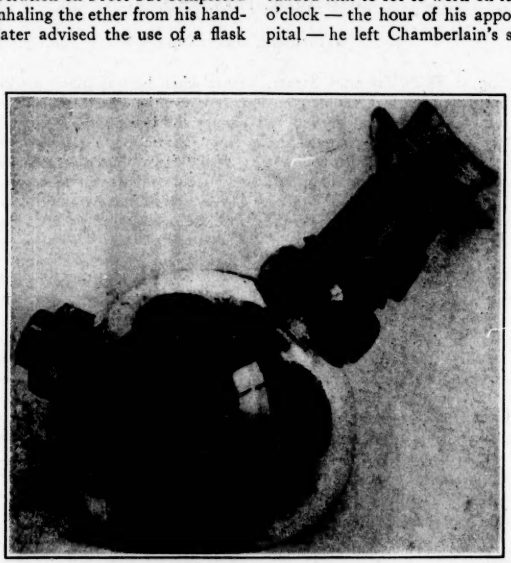


FIGURE 1. *Morton Ether Inhaler (1846).*
This model is the one generally considered to have been used by Dr. Morton at his first public demonstration of ether anesthesia at the Massachusetts General Hospital on October 16, 1846. (Courtesy of the Massachusetts General Hospital.)

> The . . . apparatus [Fig. 1] consisted of a glass vessel, about six inches square, with rounded corners; one opening, two inches in diameter, was left on the top through which a sponge was inserted and the ether poured, and another, an inch and a half in diameter, on one side for the admission of external air. On the side opposite the last-named opening was a glass tube, two inches in diameter, and an inch in length, terminating in a metal mouth-piece three inches long, and of the same calibre as the glass tube. This mouth-piece was provided with two valves, one covering a circular opening, three quarters of an inch in diameter, on the top, and the other extending across it. These valves were so arranged that, when the patient filled his lungs, the upper valve shut down, closing the aperture in the top of the mouth-piece, while the one across the mouth-piece opened and allowed the ethereal vapor, mixed with atmospheric air, to pass into the lungs; and when he emptied his

lungs the pressure of the expired air closed the valve across the tube, while the same pressure opened the upper valve, and allowed the vapor, which had once been breathed, to pass into the room, instead of returning into the reservoir.

Miller[4] has stated that the principle of Morton's inhaler has been but slightly improved in all the succeeding years. With some modifications the instrument was employed by Morton for the first six months after the discovery of anesthesia; he then turned to the use of the sponge.

Accompanied by Eben H. Frost, as a former patient who had successfully inhaled ether on September 30, 1846, Morton, out of breath and a quarter of an hour late, on the historic morning of October 16 reached the surgical amphitheater in the Bulfinch Building of the Massachusetts General Hospital, where the assembled surgeons, medical students and the patient, Gilbert Abbott, a frail youth of twenty in a plush upholstered reclining chair, awaited his coming. After Morton had given Dr. Warren — who was on the point of operating without further delay — the reason for his tardiness, he filled the new inhaler with ether mixed with "French essence" to disguise its odor and anesthetized Abbott, with the success attested to by Dr. Warren's never-to-be-forgotten remark, "Gentlemen, this is no humbug."

Following the demonstration Morton was invited by the surgeons to administer ether for an operation on October 17, but before doing so he acted on a suggestion of Dr. Gould's concerning a still better valvular system for his inhaler, with the result that the second operation (the removal of a fatty tumor from a woman's arm) was even more successful than that of the preceding day. After these trials the use of the anesthetic was discontinued at the hospital until November 7.* In the meantime, Morton devoted himself to giving ether in his dental practice and soon had a record of one hundred and sixty dental operations to his credit. Within a few weeks he found it necessary to enlarge his office and take all the space available at 19 Tremont Row.

On November 7, 1846, came the supreme test of Morton's remedy — an amputation of the thigh. "Everybody awaited this test by amputation, and then only was the accumulated evidence deemed conclusive," wrote Henry J. Bigelow.[6] Dr. Bigelow, who was present at the operation of October 16 and witnessed several dental operations in Morton's office, announced the great discovery in a paper read before the Boston Society for Medical Improvement on November 9. But previous to that date, on November 3, he had read an abstract of the paper at a meeting of the American Academy of Arts and Sciences, and the paper in its entirety was published in the *Boston Medical and Surgical Journal* of November 18, 1846.[7] Less than a month before, this journal[8] had printed the brief notice later to be so frequently quoted: "Strange stories are related in the papers of a wonderful preparation, in this city, by administering which, a patient is affected just long enough, and just powerfully enough, to undergo a surgical operation without pain." This was the first notice of anesthesia to appear in any medical publication.

Morton, endeavoring to keep his compound a secret one, had been informed, prior to the amputation of November 7, that the surgeons must be told the nature of the substance used before its further employment at the hospital, and in a letter to Dr. Warren — whom he had already informed — he had made the announcement that he was employing sulfuric ether. The mention of sulfuric ether also occurred in the patent for the discovery, applied for jointly by Morton and Dr. Jackson on October 27, 1846, and granted on November 12 of that year. Morton, however, still lacked a specific name for his compound, and a meeting was held at Dr. Gould's house on November 20 for the purpose of selecting one. "Letheon" (derived from a Greek word *lēthē* meaning oblivion, the name of one of the rivers of hell, of which the souls of the dead were supposed to drink, inducing forgetfulness of the past, after they had been for a certain time confined in Tartarus, a region of Hades) was on a list of names submitted and was immediately chosen by Morton. The term "anaesthesia," likewise of Greek origin, did not seem to interest him when it was proposed on the following day by Dr. Oliver Wendell Holmes, who had been present at the meeting.

Letheon served both as a name for ether and as a designation for the unique series of advertisements, circulars and pamphlets relating to the discovery, that Morton published from the latter part of November, 1846, to May, 1847, some of the earliest of these notices appearing in the advertising pages of the *Boston Medical and Surgical Journal* and the *Boston Evening Transcript*. The first description of the Letheon publications, some of which have become excessively rare, was given by Benjamin Perley Poore[9] in *Historical Materials for the Biography of W. T. G. Morton*, published in 1856. In 1858 practically the same account appeared in Nathan P. Rice's *Trials of a Public Benefactor*.[10]†

Terms derived from Letheon also served to designate the ether inhaler and the method of administering the drug, namely "letheonic apparatus" and "letheonising." These terms were used, perhaps for the first time, in the communications of James A. Dorr, an American residing in London and one of the special agents employed by Morton while he was attempting to enforce his patent here and

*According to Hodges,[5] Morton never gave ether for more than five or six operations at the Massachusetts General Hospital, although he continued to administer it to some extent for operations performed by the hospital surgeons and others in private practice. Dr. Henry J. Bigelow, having conducted extensive experiments and become thoroughly familiar with the use of ether, anesthetized the majority of patients undergoing operations at the hospital during the year following the introduction of anesthesia.

†A bibliographical description of these publications, listing them for the first time in the order of their appearance, has been given by Dr. John F. Fulton under the title, "The Morton and Warren Tracts on Ether (Letheon)," which was published as an appendix in *The History of Surgical Anesthesia*, by Thomas E. Keys (New York: Schuman's, 1945).

abroad and to control the use of ether by the sale of licenses and inhalers for its administration in surgery. By virtue of his identification with the Letheon pamphlets, the most prominent of these agents was Edward Warren,* who represented Morton's interests in Washington and Paris and edited three editions, running into five issues, of the pamphlets under the title, *Some Account of the Letheon.*

Despite strong medical opposition to anesthesia, exemplified in a much-quoted editorial, with its charges of quackery, in the Philadelphia *Medical Examiner* for December, 1846, as well as similar pronouncements in such publications as the *Annalist*,[13-14] a New York journal, and the *New Orleans Medical and Surgical Journal*,[15] — to say nothing of attacks by the dentists, headed by Dr. J. F. Flagg, of Boston, — Morton's inhaler was widely distributed. Through his own efforts or those of his agents, it appears to have come into fairly extensive use in this country within four or five months after his initial demonstration of ether. The use of the instrument, together with ether, was offered free to all charitable institutions.

The drug was employed at an early date for several operations, including an arm amputation, by Dr. Abel L. Peirson, the leading surgeon of Salem and Essex County, whose report of his cases[16] — all successful — was the first account of private surgical operations under anesthesia to be published. Dr. Peirson's use of Morton's inhaler is implied by the statement that the anesthetic was administered by a dentist, Dr. Fisk.

Among the first surgeons of prominence outside of New England to make use of the instrument was Valentine Mott, of New York City, who tested it with success in operations for tumor and anal fistula in December, 1846, the earliest of these being performed on December 8. Other operations were performed in New York City by Dr. A. L. Cox,[17] an early and enthusiastic advocate of Letheon. All the first experiments there were supervised by Dr. Horace Kimball, a dentist, who acted as Morton's agent and used the apparatus in his own practice. About the middle of January, 1847, ether analgesia by means of the inhaler was tried at the New York Hospital. But the existence of the patent and the concealed nature of the remedy — for even when it was known to be sulfuric ether a certain aura of mystery surrounded its preparation for a time — rendered Letheon unpopular in New York and hampered the immediate adoption of anesthesia in that city.

With the spread of anesthesia in the South and West during the winter of 1847, Morton's inhaler was introduced in such cities as New Orleans, St. Louis and Cincinnati, the instrument, strangely enough, figuring in a fatal case of chloroform inhalation† occurring in Cincinnati a year later. The early tests of ether in these cities were apparently highly successful, and in New Orleans the editors of the *New Orleans Medical and Surgical Journal*,[20] who had witnessed the first operation under ether there — a thigh amputation performed at the Charity Hospital on February 25, 1847 — promptly reversed their unfavorable judgments concerning the discovery.

In Georgia, where Dr. Crawford W. Long performed the first surgical operation under ether anesthesia in March, 1842, using a saturated towel, and from time to time performed other operations under the drug but did not publish his findings until 1849,[21] successful experiments, with a handkerchief the favored means of administering ether, were conducted at the University of Georgia and the Georgia Medical College following the announcement of Morton's discovery. Paul Fitzsimmons Eve, professor of surgery at the Georgia Medical College, co-editor with Dr. I. P. Garvin of the *Southern Medical and Surgical Journal* and one of the vice-presidents of the National Medical Association, appears to have been the first of the Georgia physicians to investigate the discovery at this time, making inquiries concerning it as early as November, 1846.[22]

Some tests of ether took place in Baltimore in the late autumn of 1846, although the first Maryland physician to adopt the use of anesthesia was a young surgeon in Frederick, Samuel M. Tyler.[23] The early Baltimore experiments were not so successful, perhaps owing to impurities in the ether. A handkerchief or sponge in preference to the inhaler was employed there, as in Philadelphia, where the first surgical operation under the drug — a finger amputation performed by Dr. William Gibson — did not occur before May, 1847. According to Parrish,[24] however, a number of reputable Philadelphia dentists had employed ether regularly in their practice for several months previous to that date.

As stated earlier, a number of inhalers made their appearance in this country shortly after Morton's. Late in December, 1846, — a time when ether was often referred to as the "new gas," — the *Boston Medical and Surgical Journal* published[25] the following:

> In the face of the patent . . . instruments used in administering the gas, made principally of glass, with metallic fixtures, such as a mouth piece, valves, etc., are manufactured in this city to a great extent. One person assured us that the demand far exceeded his ability to manufacture the article. Several individuals not only advertise that they prepare the *air of forgetfulness*, but that they have the apparatus also — and from what is bruited about the town, a thriving business is conducted by those who stand in no fear of patents. . . . Some of the artists consider that the administration, only, was secured by the

*Warren's own dislike for the term "agent" as applied to his association with Morton was expressed in a contemporary issue of the *Boston Medical and Surgical Journal*.[11]

†That of Mrs. Martha G. Simmons, thirty-five years of age and apparently in good health, who died within ten minutes after inhaling chloroform for a dental operation. The anesthetic was inhaled from a saturated sponge placed in Morton's apparatus and filling about a third of the glass globe. This fatality, which occurred on February 23, 1848, and was reported in full in the *Western Lancet*[26] and the *St. Louis Medical and Surgical Journal*,[1] attracted wide attention.

patent, and not the instrument; others are of the opinion that such a gas-holder as they produce, is no infringement of a right secured to others, inasmuch as their work is an invention of their own. . . .

It appears that not a few inhalers reached the Massachusetts General Hospital. "After its acceptance of the discovery," wrote Hodges,[26] "the hospital was overwhelmed with inhaling apparatuses of every device and size — most of them cumbersome and expensive — sent them by the makers. . . . It is to be regretted that these contrivances were not preserved, as they would now be interesting curiosities."

Morton himself, at first sufficiently persuaded that the inhaler was the best means of administering ether, if not indispensable to the success of his discovery, contracted for hundreds of sets of apparatus, as well as globes, retorts and other glassware for each modification of his instrument. All these were to be left valueless on his hands with the adoption of the conical sea sponge, employed at the Massachusetts General Hospital by J. Mason Warren[27] in March, 1847, and introduced in England at about the same time. Morton bowed to the inevitable and substituted the sponge for his inhaler, warmly praising this new medium in a letter to the *Lancet*, published July 17, 1847. On November 13 of that year, however, he and Dr. Augustus A. Gould took out a patent for an apparatus* "to be used for the purpose of administering to persons or introducing into their lungs the vapors of ether or various other chemical matters." Features of this inhaler included an evaporating vessel with a special system of induction and eduction valves, a reservoir from which the evaporating vessel could be supplied and a mouthpiece with a supporting flange or lip.

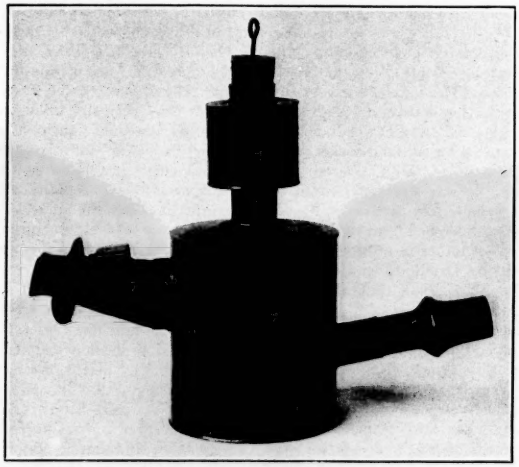


FIGURE 2. *Morton and Gould Ether Inhaler. (Photograph from United States National Museum.)*

This was protected by U. S. patent 5365, issued on November 13, 1847. The model is entirely made of tinned metal, with the exception of the cork used as a stopper in the metal reservoir (which could also be made of glass or other suitable material) and the sponge. The mouthpiece, with a supporting flange or lip, is shown on the left, attached to the evaporating vessel, which contained the sponge.

* * *

Meanwhile the instrument makers in Europe had not been idle. The news of the discovery had reached London in the middle of December, 1846. On November 28, Dr. Jacob Bigelow, the father of Dr. Henry J. Bigelow, sent a letter giving an enthusiastic account of the ether demonstration and subsequent operations at the Massachusetts General Hospital to Dr. Francis Boott, of London, a physician with many Boston affiliations and Bigelow's personal friend. He likewise dispatched a copy of the *Boston Daily Advertiser*, which contained an

*A model of this apparatus in tinned metal is now in the Smithsonian Institution, United States National Museum. A complete account of it has been given by Dr. George B. Roth.[28] It is here reproduced (Fig. 2) through the courtesy of Mr. J. E. Graf, assistant secretary, and Dr. Charles Whitebread, associate curator of medicine, Smithsonian Institution.

article by Dr. Henry J. Bigelow announcing the discovery, first published in the *Boston Medical and Surgical Journal* of November 18. Receiving these communications on December 17, Dr. Boott lost no time in informing his associates, including the Gower Street dentist, James Robinson. Private letters from Dr. John C. Warren and Dr. John Ware sent to the *British and Foreign Medical Review* reporting the discovery were also received about that time, and the inhalation of ether became the "all-engrossing subject."

On December 19, Robinson gave ether to Miss Lonsdale, a relative of Dr. Boott's, and painlessly extracted a molar tooth. The inhaler used on this occasion consisted of the lower part of Nooth's apparatus (used for making soda water) with a flexible tube, to which was attached a ball-and-socket valve and a mouthpiece resembling those generally employed for inhalation. It was later referred to by Robinson[29] as "a very imperfect apparatus, hastily got up, and which was condemned from its ill success in cases on the 20th." Another form of the inhaler was promptly devised by Dr. Boott and Robinson and made by William Hooper, a chemist and instrument maker in Pall Mall.

Employed in many of the earliest experiments carried out in London and undergoing various modifications, the inhaler in its general form consisted of two stoppered glass vessels, taken from the popular Nooth's apparatus. The vessels contained pieces of ether-saturated sponge, cut into triangular shapes and arranged in such a manner as to present as large a surface as possible for the rapid evaporation of the ether. The vapor was conveyed through an elastic inhaling tube, with a pad to be held over the mouth to prevent the breathing of free "atmospheric air" a point stressed by the designers. The pad was kept in place by the operator or his assistant. A stopcock attached to the mouthpiece regulated the volume of the ether vapor, and a nose spring, which practically all European inhalers featured in one form or another, compressed the nostrils when necessary.

This instrument was well publicized during the first months of ether inhalation in Europe, reproductions or references to it appearing in the *Illustrated London News* of January 9, 1847, the *Lancet* of January 16, the *London Medical Gazette* of January 29, the *Gazette des Hôpitaux* of February 13 and other journals. A cut of the inhaler in its improved form was also reproduced in Robinson's *Treatise*, published in the spring of 1847.

On the day of the first tooth extraction — Saturday, December 19 — Robert Liston, informed of the discovery by Dr. Boott, called on his friend Peter Squire, a well known London chemist, with the unusual request to have an inhaling apparatus made ready for a surgical operation — an amputation of the thigh — to be performed under ether narcosis on the following Monday. It was then past midday, but Squire met the emergency. Like Robinson, he employed a Nooth's apparatus. The upper detachable cylinder was packed with pieces of sponge, and a flexible tube with an ordinary bronchial inhaler mouthpiece was fastened to the exit, the patient's nostrils being held by the fingers. Saturating the sponges with ether, Squire, after some preliminary difficulty, completely anesthetized his nephew, William Squire, later Dr. William Squire, F.R.C.P., who had volunteered his services as a subject for inhalation.

On December 21, 1846, the first successful surgical operation under anesthesia in Europe, so graphically described by F. William Cock,[30] took place at the University College Hospital in London. Liston, then at the height of his distinguished career but to die before another year was out from an aortic aneurysm, amputated the limb with his accustomed skill and rapidity after the patient had been placed under the influence of ether by William Squire, using the elder Squire's inhaler. Among the students thronging the amphitheater on this occasion and hearing Liston — wildly enthusiastic — predict that in six months no operation would be performed without ether was Joseph Lister.

Within the next few days James A. Dorr informed the medical profession and the public of Morton's patent rights by means of a letter addressed to the *Lancet* stating, "that the process for procuring insensibility to pain by the administration of the vapour of ether . . . is patented for England and the Colonies, and that no person can use that process, or any similar one, without infringing upon the rights legally secured to others." This statement was published with other early notices of anesthesia that appeared in the *Lancet*.[31]

The patent at once became the cause of a great deal of unfavorable comment and misunderstanding in Europe, as it had in this country, and efforts to have it recognized met with little success, as may be judged from the following notice of Dorr's,[32] issued on January 30, 1847, and printed in the *Pharmaceutical Journal and Transactions* under the heading "Letheonic Apparatus."

> I feel it to be a duty to inform the Medical and Surgical Profession, and the Public in general, that in order to insure the *safe* use of the Letheon, certain conditions rigorously are necessary in the apparatus employed. It is possible to strangle instead of letheonising, and I would therefore urgently advise every operator, whether licensee or infringer, to be careful that all the air-passages of the apparatus used be of large diameter. . . . This diameter should not be in any part less than three-eighths of an inch bore, and particular attention should be given that there is no obstruction to the free circulation of air or vapour through the valves. I regard the practice of compressing the nostrils of a patient, by means of a spring or other instrument, as highly dangerous and improper. The nostrils should be closed by the fingers of a prudent and experienced person. *Asphyxia and etherisation are two very different things.* It is trusted that no one will be so ungenerous or so unwise as to construe this information, which is communicated from motives of humanity, into an abandonment of any lawful claim.

This was signed by Dorr as agent for the proprietors of the Letheon.

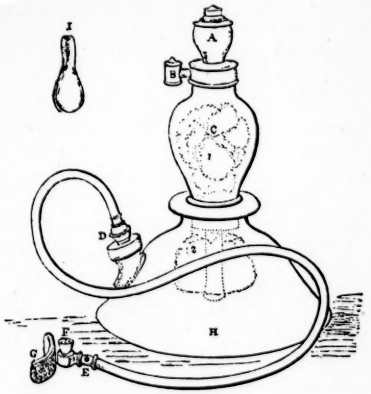
Other notices and letters of Dorr's in defense of the patent and Morton's claims to priority of discovery, several of which were published in the *Lancet*, continued to be issued during the winter of 1847. He also prepared, according to Rice,[33] a number of sets of expensive apparatus with full instructions for their proper use. These, in accordance with the custom prevailing in monarchial countries, he forwarded in Morton's name to the principal European rulers, as well as to many surgeons of prominence.

Following Liston's trial of anesthesia, Peter Squire reconstructed his inhaler, employing special patented valves (Read's valves), so arranged as to prevent the expired air from returning into the apparatus, a ferrule near the mouthpiece for regulating the quantity of air admitted and a spring for closing the nostrils. The inhaler, a glass urn, was supplied with ether at the top by means of a metal funnel that formed part of the stopper of the urn. The ether fell through a nozzle and was distributed in a shower on the sponge. Too rapid evaporation of the anesthetic was prevented by the patented valve in this part, which admitted air at each inspiration and then closed instantly. The mouthpiece, made at first of wood and later of glass or metal, was constructed to fit the mouth and entirely enclose it.

With all its carefully executed detail, this apparatus was one of the more elaborate, if not the most costly, of the many inhalers exhibited and discussed at a meeting of the Pharmaceutical Society held in London on January 13, 1847, — when interest concerning the successful administration of ether by an instrument was at its height. The meeting was well attended, the lecture room of the society being crowded with members and medical men who had gathered to hear Squire read a paper[34] that presented a general discussion of the subject of inhalation and gave an account of his own instrument (Fig. 3), which became one of the principal English inhalers of the period.

Dividing the honors with Squire's apparatus was the inhaler of Boott and Robinson, also exhibited on this occasion and discussed by Hooper, who had introduced several modifications and offered it as an instrument employed in a large number of cases without failure. An elaborate system of valves and an improved nasal spring had been added to Nooth's glass apparatus. A special feature was the reconstructed pad for the mouth; this pad, later described by Robinson[35] in his treatise, was so flexible that by pressing its edges the operator could fit it to a mouth of any size without difficulty. It was made of thin sheet copper, covered with soft leather on the inside, which was thickly stuffed and padded with wool. An opening in the center of the pad provided for an ivory or amber mouthpiece to be screwed on and kept in the mouth during inhalation. An instrument with similar features continued for some time to be manufactured by Hooper and bore his name.

Other forms of apparatus shown at the meeting, a number of which were subsequently reproduced in the *Pharmaceutical Journal*, included a wide variety of urns, jars, cylinders and funnels, with fittings of amber, ivory, brass, ebony, pressed steel, tin and vulcanized rubber. Bladders were also in favor and



A. The Urn with its stopper, into which the ether is poured.
B. Valve which admits the air.
C. Contains sponge saturated with ether.
D. Valve which opens at each inspiration, and closes at each expiration.
E. Ferule for regulating the quantity of atmospheric air admitted.
F. Valve for the escape of expired air.
G. Mouth-piece.
H. Lower vase.
I. Spring for closing the nose.

FIGURE 3. *Squire's Ether Inhaler (1847).*

were recommended for the use of dentists on account of their simplicity. They possessed the additional advantage of not being protected by patents or caveats. Ivory mouthpieces were popular, and silver was also used in some instances. A mouthpiece of glass was advocated by Jacob Bell, editor of the *Pharmaceutical Journal*, who[36] expressed the opinion that some persons might object to apply to their mouths a pad or wooden tube saturated with moisture from the patient who had used it last. The glass mouthpiece could be removed and as easily washed as a cup or wineglass.

Interested in obtaining a simple apparatus that would serve its purpose economically, since many instruments had been designed without thought of the expense, Bell had constructed an inhaler from an ordinary green quart bottle. This had a bung with two openings, through one of which a glass tube for conveying the ether vapor passed nearly to the bottom of the bottle, the other opening being

fitted with an inhaling tube and valves. The glass mouthpiece, similar in form to an eyeglass or cup, although somewhat larger, was to be added to the inhaling tube. In place of a sponge a little water was introduced into the bottle with the ether, through which the bubbles of air passed from the lower end of the glass tube, thus becoming saturated with the vapor. This apparatus, as exhibited at the meeting, was recommended as one easily put together by a surgeon in the country who could not command the facilities of a London hospital. A modified and more elaborate form of this apparatus (Fig. 4) was later brought out by Gilbertson, a London designer who had assisted Bell in the production of the first instrument. In the illustration two types of glass mouthpiece are seen.

Bell believed that skill and practice were prerequisites to the really successful inhalation of ether, so that failure in some cases should not always be attributed to the instrument employed, an opinion that Squire had also expressed and one that was shared by others at that time.

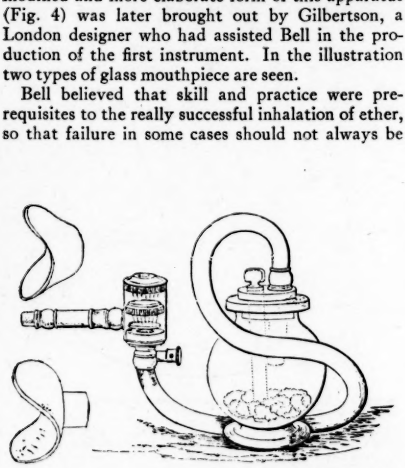


FIGURE 4. *Gilbertson's Ether Inhaler (1847).*
Two types of glass mouthpiece are to be seen on the left.

Still another form of simple apparatus with an element of novelty was an adaptation of the German pipe, offered by Tracy, of St. Bartholomew's Hospital, who during the course of some seventy or eighty tooth extractions had first tried many of the usual types of inhalers. The general efficacy of these instruments when properly employed he considered as being on a high level, for when failures had occurred he believed, with Squire and Bell, that the patient was perhaps at fault. But he regarded the size of most of the inhalers as an objection, especially in the extraction of teeth, a procedure in which the operator should be able to administer the vapor without the aid of assistants and easily dispose of the instrument when the patient was once under the influence. Therefore, with the hookah first in mind, Tracy had adopted the German pipe as meeting the desired requirements. This pipe (Fig. 5) was made of glass, mounted at the top with a brass cap and stopcock, into which was screwed a sixteen-inch elastic tube. The tube was surmounted by a double-valve mouthpiece, and a padded steel compress served for securing the nostrils. As much ether was poured into the pipe as would fill the well and saturate the sponges. The mouthpiece was placed between the patient's teeth, the stopper removed, the stopcock turned on, and the patient directed to inhale in the natural way. In subsequent accounts of the instrument, Tracy[37] stated that he had used it for a large number of operations and had found it better than any other apparatus he had employed.

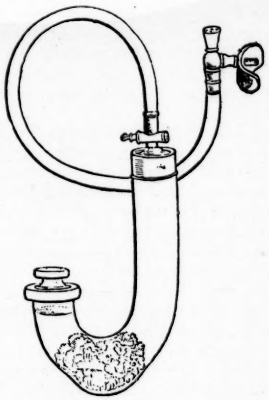


FIGURE 5. *Tracy's Ether Inhaler (1847).*
This is constructed on the lines of a German pipe.

The inhaler had been constructed by Ferguson, the instrument maker to St. Bartholomew's Hospital, who had supplied all previously used by Tracy and was among the designers having three or more varieties of inhalers on display at the meeting. Reporting on this meeting, the *Lancet*[38] published the following comment in regard to the number of instruments shown, "they were really so numerous, that it would appear that the whole scientific portion of the members of the Society, as well as that of many others, had been employed in inventing and contriving means for administering the vapour of ether." Nevertheless, still more inhalers were to be introduced, including John Snow's water-heated apparatus, of which there will be further mention.

Such instruments as Startin's "Pneumatic Inhaler," with a brass nose spring and a special fumigating device, which could be substituted for the

ether chamber or reservoir of the inhaler, some other substance than ether being employed, came into popular use for a time, as did two inexpensive tin inhalers, one of them portable (Fig. 6), devised by Alfred Smee, F.R.S. The portable inhaler — one of the earliest — was severely simple, consisting of

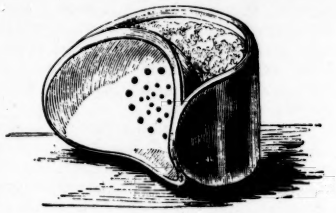


FIGURE 6. *Smee's Portable Ether Inhaler (1847).*

little more than a metal mouthpiece to which was attached a small pouchlike receptacle of the same material for holding the ether and sponge. In the first form of this instrument, however, no provision

FIGURE 7. *Salt's Portable Ether Inhaler (1847).*
The top was pulled out and the ether was poured on the sponges in the metal cylinder, the top then being replaced. With the air holes either partially or entirely exposed, the inhaler was then ready for use.

had been made to prevent the possibility of the ether from running into the mouth during inhalation.

Hedley's wooden inhaler, although not classified as portable, was another compact instrument. It was a cylinder about nine inches in length, shaped at one end to form a mouthpiece and made of boxwood, lignum vitae or cherry, with valves of the same material. The latter were placed near the mouthpiece, the ether being received from a sponge introduced into the body of the instrument. More elaborate, but advocated as of convenient size and form for the pocket, was Salt's portable inhaler (Fig. 7), produced at Birmingham. By means of a revolving plate with corresponding openings, fitted into one end of the cylinder or body of the apparatus, and through the alternate admission of air and ether, the volume of the vapor could be regulated without removing the instrument from the mouth. The other end of the cylinder was fitted with a revolving tube, which also had corresponding apertures for controlling the quantity of air admitted. To prevent evaporation, both ends of the apparatus could be closed when it was not in use.

Gallard's portable instrument (Fig. 8) was a cylindrical tin box, the lid of which contained an

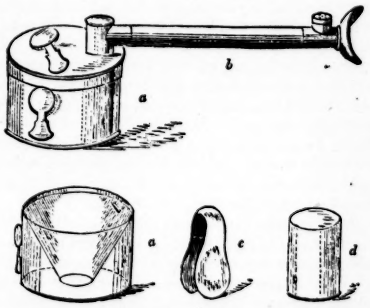


FIGURE 8. *Gallard's Portable Ether Inhaler (1847).*
a *is the cylindrical tin box*; b, *a tube of sufficient caliber to permit a two-ounce bottle of ether to be packed in it, thus forming a case*; c, *the mouthpiece and valves*; d, *one of the caps to tin tube used as a bottle case*; *and* e, *the brass clip for closing the nostrils.*

adjustable hole for the admission of air in almost direct communication with the tube. The box itself also had an adjustable hole for admitting air in closer connection with the ether. The tin inner lining of the box, which was conical in shape, allowed two or three ounces of ether to remain in it without spilling, whereas a small inside tube provided for the ether to be poured back if not wanted. A mouthpiece, valves and a brass nose clip, not unlike a pair of sugar tongs, completed the apparatus. All parts of it, with the exception of the tube, were made to fit into the box. When opened, the larger hole supplied the ether vapor in diluted form, and the smaller one a much more concentrated vapor. The holes could be closed during each expiration

but were supposed to be opened by the anesthetist before each inspiration.

A variety of portable inhalers — some as small as four and a half by two inches — were soon being made. They were regarded as especially appropriate for women and, fitted into morocco or other suitable cases, proved popular at gatherings where ether was inhaled for exhilarating purposes only. Portable models that had the basic features of their principal inhalers were brought out by Squire, Hooper and later by John Snow. Hooper likewise designed what was perhaps the first inhaler for horses. This instrument was formed of a specially constructed muzzle with inhaling tube and valves, with a vulcanized rubber bag attached for holding the ether and sponge. The whole was adjusted to the animal by means of a headpiece, similar to a bridle, and a tightly fitting rubber band placed over it near the top.

Squire's large inhaler was apparently the first to come into use in Edinburgh. The instrument had been dispatched by Liston to his friend James Miller, who performed the initial operation under anesthesia in Edinburgh at the Royal Infirmary.[39] This took place about the middle of January, 1847. The discovery excited great interest among the Scots and various forms of inhaling apparatus were soon being tested — although not always successfully — in surgical procedures. In Edinburgh, as in Dublin,* a simple form — the glass jar or flask variety, with or without valves, seemed to be the preferred type of inhaler and was chosen by such men as James Y. Simpson and James Syme.

Simpson, who introduced the use of ether in obstetrics on January 19, 1847,[41] employed a portable glass flask without valves, which contained ether poured on a piece of flannel or other absorbent material. The flask had a mouthpiece and an aperture in the side to admit air. He continued to make use of this device or a concave sponge in administering ether until his introduction of chloroform anesthesia in November, 1847,[42] when he gave the anesthetic on a handkerchief. (In his original patent of 1846, Morton, it may be said, had listed both the sponge and the common glass flask as among the effective methods of giving ether.)

Syme, prompt in his employment of anesthesia as he was in his later adoption of asepsis, following the precepts of his son-in-law and greatest pupil, Joseph Lister, used practically the same ether apparatus as did Simpson. But he had previously experimented with other apparatus, which gave such poor results that he[43] states, "in common with many members of the profession, who had experienced similar discouragement, I . . . resolved to abandon the use of ether; at all events until better results could be obtained." After the advent of John Snow in the field of anesthesia and his success, Syme was sufficiently encouraged to recommence his own employment of ether, which he did successfully, although, one of the first besides Pirogoff to adopt anesthesia in Europe, he maintained a somewhat conservative attitude in regard to its uses for a time.

James Kemp, a philosophical instrument maker of Edinburgh, constructed a portable inhaler that was included among five principal inhalers listed by the *Edinburgh Medical and Surgical Journal*[44] in the following order: Squire's ("the one most commonly employed in the Metropolitan hospitals and in London generally"), Snow's, Startin's, Robinson and Boott's, and Kemp's.

Kemp's inhaler, fitted into a case ten inches by four, was similar to the German pipe of Tracy's apparatus and consisted of three parts — a strong bent syphonlike tube for holding the ether, a stopcock for preventing evaporation when the instrument was not in use, a flexible tube with the usual inspiratory and expiratory valves and a mouthpiece. The tube could be made of glass, block tin, brass or any other suitable material, and was large enough at the base to hold the pieces of sponge. Especially recommended was the inhaling tube, of the same size as the trachea, which allowed the patient to breathe through it freely and became "a continuation of the windpipe," as the different parts of the apparatus such as the stopcock, valves and mouthpiece, were all of the same dimension. The mouthpiece was of ebony but could be constructed of glass or earthenware. The all but inevitable nose spring, made of steel, completed the instrument. A second form of the inhaler was brought out as a table model. The bent tube for holding the ether, of the first design, was replaced by a glass urn mounted on a mahogany pedestal, but the essential parts of both models, including the mouthpiece, were the same. Both were reproduced in the April, 1847, number of the *Edinburgh Medical and Surgical Journal*, together with the inhalers of Squire and Startin.

Although Squire's inhaler was undoubtedly in demand, the administration of ether in London, as previously indicated, was largely in Robinson's hands during the first four or five weeks following the announcement of the discovery. This included both private and hospital practice, as well as a certain number of veterinary operations. Beginning with such painful procedures as the removal of decayed roots of previously extracted teeth, Robinson, using his modified inhaler, was soon giving ether for general surgery at the Metropolitan, King's College, St. Thomas's, Guy's and other hospitals. He apparently met with a considerable measure of success, although, as Sir Benjamin Ward Richardson[45] stated, the first inhalations of ether in England were "not so successful as to astonish all the surgeons, or to recommend etherization as a common practice." Here we have the echoes of Syme's pronouncements. Richardson's statement

*The first surgical operation under ether in Ireland was performed by J. MacDonnell on January 1, 1847, at the Richmond Hospital in Dublin.[40]

might well have included some of the early trials of anesthesia in France and other parts of the Continent.

In England distrust arose from the way in which the anesthetic was administered. It did not always take effect, and fatalities directly or indirectly attributable to the drug were reported. Liston himself was said to have lost much of his early enthusiasm for anesthesia. To offset these failures the administration of oxygen to resuscitate etherized patients began to be advocated. In accordance with this, Hooper equipped his large inhaler with a gas bag,[46] and by the end of March, 1847, Robinson was giving oxygen, following the administration of ether, as a routine procedure. John Snow at first took an active part in opposing the practice, to be revived later on.

Snow, who was the first physician to specialize in giving anesthetics and the author of the initial textbook on the subject, was six years Morton's senior. He served a long apprenticeship in his profession and was always a serious worker. He had received from the University of London the degree of Bachelor of Medicine in 1843 and that of Doctor of Medicine in 1844. He had engaged in various experimental studies on respiration and asphyxia, the results of which he had published, but he had failed to achieve any prominence. The ether discovery proved to be the turning point in his career.

Soon after the news of the discovery, and without any immediate thought of specialization, Snow carried out experiments on animals and on himself for which his previous work had prepared him. Richardson[47] records that the deciding factor in Snow's resolve to take up anesthesia was his chance meeting with a druggist of his acquaintance, who, carrying a large apparatus under his arm, informed him that he was getting into quite an ether practice, giving the drug "here, there and everywhere."

By January 23 Snow had perfected an inhaler. This instrument, as he acknowledged, was based on the principles of an inhaler brought out in 1842 by Julius Jeffrey, F.R.S., as an apparatus for the inhalation of "aqueous vapor." A contemporary description of Snow's inhaler, published in the *Pharmaceutical Journal*,[48] is as follows:

> A round tin box, two inches deep, and four or five inches in diameter, with a tube of flexible white metal, half an inch in diameter, and about a foot and a half long, coiled round and soldered to it. There is an opening in the top of the vessel, at its centre, for putting in the ether . . . and attaching the flexible tube belonging to the mouth piece. In the interior is a spiral plate of tin soldered to the top, and reaching almost to touch the bottom. When used, the inhaler is to be put in a hand basin of water, mixed to a particular temperature, corresponding to the proportion of vapour that the operator may desire to give, and the caps being removed, and the mouth piece attached, when the patient begins to inhale, the air gains the desired temperature in passing through the metal pipe; it then comes upon the surface of the ether, where it winds round three or four times before entering the tube going to the mouth piece, thus ensuring its full saturation, and preserving it at the desired temperature. [Snow usually maintained the temperature between 60 and 65°F.] There is no valve or any obstruction to the air till it reaches the mouth piece, which is of the kind used in other inhalers and contains the valves necessary to prevent the return of the expired air into the apparatus. . . .

With this instrument Snow asked to be allowed to administer ether at St. George's Hospital. He received permission to give it to out patients for tooth extractions, but when the success of his method had been observed for a day or two he was invited to administer ether for a surgical operation. This occurred on January 28, 1847, and shortly thereafter he was administering the drug regularly on operating days. He gave ether with almost unvarying success and soon made his appearance at University College Hospital, where Liston, struck by his quiet authority, took him by the hand. From that time he became the principal anesthetist in London.

Having chosen this field, Snow devoted himself to cultivating it, and the results of his painstaking investigations soon began to be published in a series of papers, appearing chiefly in the *Lancet* and the *Westminster Medical Gazette*, the majority of them having previously been read before the Westminster Medical Society, of which he had long been a member.

Snow's ether inhaler was reproduced in the *Lancet*, the *Pharmaceutical Journal* and other journals, first being shown in the *Lancet* of January 30, 1847. Although remaining basically the same, it underwent several alterations until it reached the form (Fig. 9) that is best known. A complete description of it occurs in Snow's first book.[49] "The round tin box" of the original design became one of "japanned tin or plated copper, of the size and form of a thick octavo volume." This box served as a water bath when the apparatus was in use, and at other times contained the elastic inhaling tube and facepiece. Snow's improved facepiece, enclosing both the nostrils and the mouth and permitting respiration as the patient might desire, dispensed with the rather formidable nose spring, which he termed "rude." The central part of the facepiece containing the valves was constructed of brass, tinned iron or plated copper; the rest was of thin sheet lead sufficiently pliable, like the mouthpiece of Robinson's inhaler, as to be easily adapted to the features. The lead was covered with silk or glove leather on its outer surface and lined with oil silk where it touched the face. The valves, of vulcanized rubber, were light and so constructed as to rise with the least pressure and close again of themselves, regardless of the position in which the patient was placed. The apparatus was made by Ferguson and later by Matthews, of Lincoln's Inn, and other instrument makers.

A strong advocate of the inhaling apparatus and the control that its use permitted, Snow had not altered his opinion when he published his book in September, 1847, the sponge having then been in use for six months. "The simple sponge is prefer-

able, for all cases, to many of the apparatuses which were in use," Snow[50] wrote, "but I cannot admit that it is equal to a good apparatus." He considered it an expensive method, since "not one half of the ether which is dissipated enters either the mouth or nostrils of the patient." He spoke of using five fluid ounces of ether in keeping an elderly patient insensible for more than two hours, but he ordinarily employed two or two and a half ounces in his inhaler, which was approximately the amount used in most of the early instruments, although this varied somewhat with the age of the patient, children usually requiring less. While conceding that the sponge was the more suitable means in giving ether to infants, Snow used his inhaler with a small facepiece for children of two years and older. He conveyed the impression of not being especially in favor of rectal anesthesia, approved by Roux and first adopted by Pirogoff.[51]

With the introduction of chloroform Snow found his book, which had been well received, cast in the shade and turned to his studies of this new agent that he was later to administer, by handkerchief, to Queen Victoria on the important occasion (April 7, 1853) when she first accepted chloroform for the birth of a child and the administration of anesthesia in obstetrics — long a controversial question — was thereby firmly established.

* * *

Although bladders, either ox, sheep or pig, were frequently in use on the Continent and were advocated by Schuh, of Vienna, and others, the production of inhaling instruments quickly followed the spread of anesthesia. Any attempt to catalogue them, however, would exceed the limits of this paper. The inhaler first employed by Velpeau, which had been designed by Joseph Charrière, of Paris, well known as an instrument maker, and the apparatus of Dieffenbach's, later reproduced in his monograph *Der Aether gegen den Schmerz*,[52] may be mentioned as perhaps two of the most important of these instruments.

Largely owing to the efforts of F. Willis Fisher, a Boston physician living in Paris, ether experiments in the French capital antedated those in London by several days, the initial demonstration in a Paris hospital going back to December 15, 1846, when Fisher was invited to administer the drug for an operation at the Hôpital Saint Louis, performed by

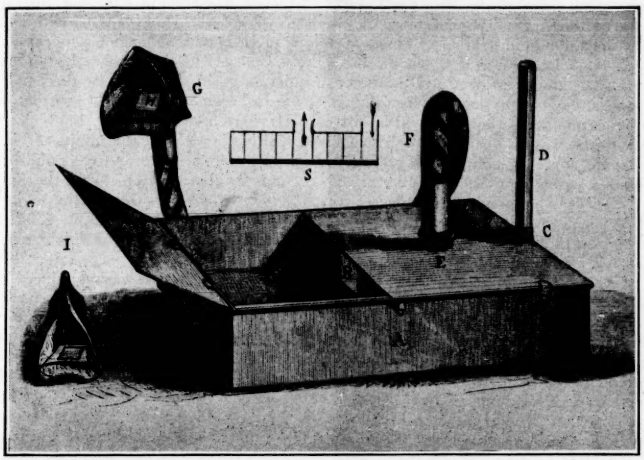


FIGURE 9. *John Snow's Ether Apparatus (1847).*

A is a box of japanned tin or plated copper; B, the spiral ether chamber of thin tinned brass or silver-plated copper; C, the opening in same for putting in and pouring out ether; D, a brass tube, five eighths of an inch in internal diameter, by which the air entered, which the patient inhaled; E, another opening in the ether chamber; F, an elastic tube about three feet long; G, the facepiece; H, the inspiratory valve; I, the same facepiece compressed to fit a small face; and S, a section of the spiral ether chamber.

Jobert de Lamballe. But the attempts to anesthetize the patient failed on this occasion, and other early experiments, including those carried out by Joseph Roux at the Hôtel Dieu and by Joseph-Francois Malgaigne at the Hôpital Saint Louis, which he reported at the French Academy of Medicine on January 12, were only partially successful. This was apparently due to defective apparatus as well as a poor quality of ether.

The arrival of one of Morton's instruments, otherwise known as the Boston inhaler, about the middle of January did much to overcome the difficulties. Fisher,[53] to whom it had been sent, stated not only that he employed it in successfully administering ether but that it served as a model for all the Parisian instrument makers.*

Velpeau, deterred by the previous failures, did not operate under ether until January 22, 1847. This operation, for tumor, took place at the Charité with the anesthetic given by means of Charrière's inhaler and was regarded as a complete success.[54]

Charrière's instrument — at once acclaimed in Parisian journals — was brought out in several forms, including a portable one. His principal model at that time was a decanter-shaped glass bottle with an unusually wide base containing the ether saturated sponge cut and distributed in sections (Fig. 11). He employed valves and the long flexible inhaling tubes so popular with the Europeans (Snow advocated one about three feet in length), as well as cork-padded nose pieces that were possibly a little lighter in their general form than the English variety. Early reproductions of Charrière's inhaler appeared in the January 26, 1847, issue of the *Gazette des Hôpitaux* and in the January 30 issue of the Paris *Gazette Medicale*. References to the instrument and its modifications continued to appear from time to time during 1847, principally in the *Gazette des Hôpitaux*. Charrière's inhaler also attracted favorable attention outside of France and was mentioned by Snow and Dieffenbach among others.

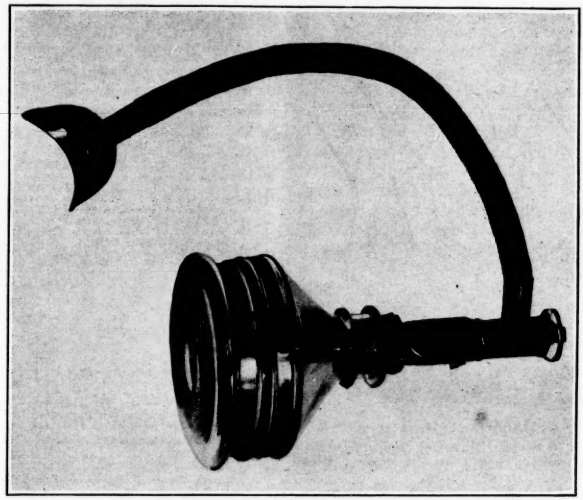


FIGURE 10. *Lüer's Inhaler (courtesy of the Massachusetts General Hospital).*

The glass, cork-stoppered vessel is six inches in diameter with a depth of five and a half inches. In place of a sponge there is a four-and-a-half-inch cotton filter. The silk elastic inhaling tube is fifteen inches in length, with a circumference of three inches. The metal fittings and the mouthpiece, which is three inches long, with a depth of approximately one and a half inches, are apparently of lacquered brass.

*In the present collection of the Massachusetts General Hospital there are two interesting models of a glass inhaler (Fig. 10) by Lüer, of Paris, to record an additional apparatus, which bear a certain resemblance to Morton's. Undated, they may belong to a later period, but the construction of the flexible inhaling tubes and metal mouthpieces seems to relate them to the early inhalers.

In *Aether gegen den Schmerz*, published about seven months after Heyfelder[55] had performed the first surgical operation (January 24, 1847) in which ether was employed in Germany, Dieffenbach gives evidence of his interest in apparatus. He mentions almost a dozen inhalers, including, in addition to Charrière's, Morton's, which he describes at some length, Robinson's and Smee's. His own instrument with its sponge-filled glass globe, was much like

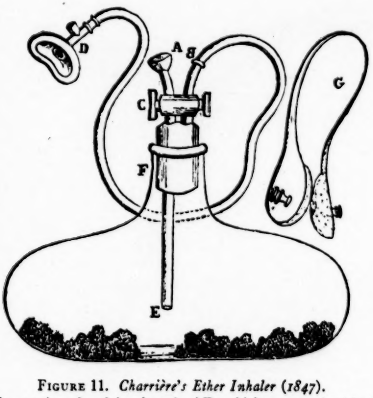


FIGURE 11. *Charrière's Ether Inhaler (1847).*
Air was introduced by the tube AE, *which connected with the inhaling tube BD, terminating in a metal mouthpiece.* C *indicates the valves, and* G, *the nose spring.*

Morton's inhaler, the chief difference being the long inhaling tube and the mouthpiece, formed like a shell and made of rubber or horn.

Written from the viewpoint of the practical surgeon, Dieffenbach's monograph as a work on inhalation anesthesia was probably the most elaborate of its kind to appear at that time. His death occurred in November, 1847, when interest was beginning to shift to chloroform as an analgesic and when new and simpler apparatus for administering it were soon to be devised by Snow, Squire, Hooper, Smee, Charrière and many others. The ether inhalers that had not already been replaced by the sponge were for the most part set aside at about that date, to be revived, nevertheless, in the years ahead.

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HEALTH BILLS PENDING IN CONGRESS*

Part Three

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IN ADDITION to the National Health Bill, many other proposals are pending in Congress. They deal with construction of essential medical-care facilities, organization of health-service programs and promotion of medical research and professional education. Some of these measures are complementary to the National Health Bill, and some are alternatives to it.

HOSPITAL SURVEY AND CONSTRUCTION BILL

Description

The Hill–Burton Bill, or Hospital Survey and Construction Bill (S. 191), is designed to assist the states in surveying their needs for construction of necessary hospitals, developing programs to meet existing needs and building public and other nonprofit hospitals in accordance with such programs.

To attain these objectives the adoption of a number of fundamental principles is proposed. A balanced program of hospitals and related facilities is to be developed throughout the country. It includes public-health centers, various types of hospitals — namely, general, tuberculosis, mental and chronic-disease hospitals and other types — and facilities such as laboratories, outpatient departments, nurses' homes and training facilities for nurses. Instead of calling for the building of federal hospitals, the bill proposes to assist the states in developing hospital programs, this assistance being confined to public and nonprofit hospitals and related facilities. The first step to be taken by the states would be a survey of all medical-care facilities within its boundaries. This inventory would be followed by the formulation of a state-wide building program. The project would have to be submitted to the federal authority in charge and, if approved, would be subsidized by federal grants-in-aid.

The number of beds to be provided under the terms of the bill is defined in detail. The total of general hospital beds for any state is not to exceed 4½ per 1000 population, except that in states having less than 12 and more than 6 persons per square mile, the limit shall be 5 beds per 1000, and in states having 6 persons or less per square mile, 5½ beds per 1000. The total number of beds for tuberculous patients is not to exceed two and a half times the average annual deaths from tuberculosis in the state over the five-year period from 1940 to 1944, inclusive. The total number of beds for mental patients is not to exceed 5 per 1000 population and that for chronic-disease patients 2 per 1000. The number of public-health centers is not to exceed one per 30,000 population. It should be borne in mind that these figures refer to projects assisted by federal funds. To assure the building of qualitatively adequate hospitals the bill requires the formulation of general standards of construction and equipment for hospitals of different classes and in different types of location; the establishment by the states of minimum standards for the maintenance and operation of hospitals; state reports on the hospital situation; and approval of state plans. Of prime importance are the bill's requirements that adequate hospital facilities be available to all the persons residing in a state, without discrimination on account of race, creed or color, and that provisions be made for adequate hospital facilities for persons unable to pay for care.

Authority for the administration of the program is vested in the states and — what is most significant — in a single state agency as the sole agency responsible for both the survey and the administration of the hospital plan. At the federal level, the responsibility rests with the Surgeon General of the United States Public Health Service, whose administrative regulations and other functions are subject to the approval of the newly created Federal Hospital Council.

At the state as well as the federal levels advisory committees would be established. The state advisory councils are to include not only representatives of nongovernment organizations or groups and of state agencies but also of the general public. The Federal Hospital Council is to consist of the Surgeon General of the United States Public Health Service as chairman and eight members appointed by the Federal Security Administrator. Five of these members must be experts in hospital and health activities, and three will represent the consumers of hospital services. All appointed members of the council are to serve on a part-time basis. The council is authorized to appoint special advisory and technical committees.

The cost of both the survey and the construction program is to be shared by the federal government and the states. The bill includes an initial appropriation of $5,000,000 for the surveys and a total of

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$375,000,000 for construction purposes, to be spent over a period of five years. This money will be allotted to the states according to definite schedules. The states are to receive 50 per cent of their own expenses — but not less than $10,000 — for surveys and planning, and from one third to three fourths of their total expenditures for construction. The provisions of the measure are to be incorporated in the Public Health Service Act and thus become an integral part of the law governing the development and administration of health services under public auspices. The Hill–Burton Bill, as described, has been passed by the Senate and is being considered by a committee of the House of Representatives.

Advantages and Disadvantages

For the first time in American history the development of a broad and balanced program of hospital and related facilities is under active consideration. If passed, the Hill–Burton Bill will put an end to the haphazard growth of facilities, with the resultant uneven distribution of all types of hospitals and the deplorable lack of certain special facilities. Due emphasis is placed on quantitative standards. The introduction of the approval system will serve not only to distribute the hospitals better but to improve their quality where indicated. The poorer states are to obtain relatively more financial aid than the wealthier ones. The administrative control is vested in the states, as it should be, and unification of the administration is proposed. The state advisory councils are composed of representatives of all groups concerned and are thus truly democratic. Enactment of the bill will influence the distribution of physicians and related groups, since it provides for the "workshops" so essential to the practice of modern medicine. The quality of medical care can be expected to improve in areas hitherto undersupplied with adequate hospitals.

The value of the bill in its present form is considerably impaired by several shortcomings. The measure does not contain provisions for the maintenance of hospitals and payment for professional services. It is satisfied with reasonable assurance on the part of states applying for grants that financial support will be available for maintenance and operation. To quote a hospital administrator who testified at the Senate committee hearing, "If people are too poor to build a hospital, they'll probably be too poor to run one." Adoption of the Hill–Burton Bill without the simultaneous passage of bills for the organization of payment for hospital and professional services will create serious problems in many areas. The danger of "ghost hospitals" must be avoided.

In vain does one look for a statement on the staffing of the hospitals. The nature of standards for the operation of hospitals is left to the states to determine. Is it not specified whether the hospitals are to be open to all qualified physicians or to be restricted to some of them, whether they are to provide luxury services, or whether the physicians will be permitted to charge unlimited fees. These are questions that require clear answers in the bill.

The proposals concerning the powers and functions of the Federal Hospital Council are contrary to the time-tested principles of sound public administration. Although composed of persons who devote nearly all their time to their private interests, the council has considerable authority, including the veto power, and important administrative functions. The Surgeon General of the United States Public Health Service and the Federal Security Administrator are made figureheads. Yet they are the very persons officially responsible to Congress and the public for the proper use of large sums of tax money. Such an administrative structure is utterly unsuitable. Councils composed of part-time members should exercise advisory functions only.

The bill fails to make reference to regional organization of hospitals. For years, experts in all civilized countries have been contending that the pattern of hospital organization that was satisfactory in the nineteenth century has become obsolete in this age of rapid transportation. The future hospitals should be developed to serve regions rather than political units, a main hospital functioning as the center of an integrated system of district hospitals, rural hospitals and health centers.

Finally, the amount of money to be appropriated appears small, considering the immediate needs for replacement of obsolete buildings and additions.

Dental-Health Bill

Senators Aiken and Pepper have introduced a bill (S. 1099) designed to amend the Public Health Service Act so as to provide assistance to states in developing and maintaining dental-health programs. The prevention, treatment and control of dental diseases are covered, as well as research in dental health care and pertinent educational projects. The program is to be financed jointly by the federal government and the states, along the lines followed in the past for health services assisted under the Social Security Act.

As it stands, the bill is too indefinite to warrant detailed discussion. Its main value lies in the fact that it directs attention to a sadly neglected field of health service, calls for the inclusion of preventive, therapeutic and educational services in one program, makes provision for research and professional education and proposes incorporation of organized dental-service plans in the Public Health Service Act.

Maternal and Child Welfare Bill

Description

The Maternal and Child Welfare Bill (S. 1318) is sponsored by Senator Pepper and other senators,

including Senator Murray. Its stated objective is to make more adequate provision for the health and welfare of mothers and children and for services to crippled children. The bill is organized in three parts, covering maternal and child health services, services for crippled children and child welfare services.

The maternal and child health services are made available to all mothers during the maternity period and to all children up to twenty-one years of age, regardless of income, race, creed, color, national origin and residence. The program provides for complete health service, which is defined as follows: " . . . medical, nursing, dental, hospital, and related services and facilities required for maternity care, preventive health work and diagnostic services for children, school health services, care of sick children, and correction of defects and conditions likely to interfere with the normal growth and development and the educational progress of children." To promote quality of service, the state agencies are required to establish standards for professional personnel rendering medical, dental, nursing and related types of care or service and standards for hospital and other institutional care and services, to provide for adequate remuneration of professional persons and to furnish opportunities for postgraduate training.

The patients are to have free choice of physician, hospital, clinic or health-service agency. Payment to physicians participating in the program is to be on a per capita, salary, per case or per session basis or, in the case of consultations or emergency visits, on a fee-for-service basis. The last-named method would therefore be the exception rather than the rule. In line with principles established under the Social Security Act, approval of state plans is mandatory, and these plans must provide both for financial participation by the state and for a program effective in all parts of it.

The proposed service would be financed jointly by the federal government and the states. The bill makes an initial appropriation of $50,000,000 for payments to states that have submitted approved plans for developing such programs and providing such care and service, and it defines in detail the schedule for the allotments to the states. The United States Children's Bureau is to have administrative responsibility at the federal level and is aided by federal advisory committees. State agencies are to be the heart and center of the proposed administrative organization, and they are to be assisted by general advisory councils, composed of representatives of the public as well as of the professions and agencies and by technical advisory committees.

The services for crippled children are to be expanded by adoption of the same basic policies as those proposed for the extension of maternal and child health services. The initial appropriation for grants to states is set at $25,000,000.

The child-welfare services are designed to curb delinquency, and their extension is to be financed by an initial appropriation of $20,000,000.

Advantages and Disadvantages

A bill dealing with maternal and child health service is certain to find a sympathetic response. As Sir George Newman once wrote, "The safeguarding and nurture of motherhood and child life must be a first requirement in the building of any nation." What, then, are the relative merits of the health provisions of the Maternal and Child Welfare Bill?

The measure would make service available to everyone without discrimination, provide for completeness of service and develop the program gradually over a ten-year period so as to stimulate the improvement of standards as well as of essential facilities and services. These are highly commendable features. But the bill also has many weak points.

The health provisions of the bill are a halfway measure, since one age group and one condition — maternity — are singled out. The family is divided, and this is contrary to the basic principle of serving the family as a unit. The demarcation by age is artificial and poses intricate administrative problems. The people to be served will wonder why a married woman gets medical care when she is pregnant but not when she is sick, and why persons older than twenty-one are excluded. It would be wiser to concentrate on the passage of a health bill designed for both children and adults and covering all health conditions.

There is little in the bill concerning the organization of professional services. No definition of professional personnel is given, in contrast to the National Health Bill, which clearly states that licensed physicians, dentists and nurses shall be qualified to render service. Does this omission imply that nonmedical practitioners can expect to be admitted? The term "group practice of medicine" does not appear in the bill. This is all the more regrettable because effective child-health service requires organized teamwork by specialists and general practitioners.

The funds for the support of the program are to be obtained by general taxation. This raises the old question of the relative merits of general taxation and insurance.[1] In deciding on the future policy utmost care should be taken to avoid the establishment of two systems of raising funds for the support of services for self-supporting people.

The sum to be appropriated is extremely modest, to say the least. The amount of $50,000,000 for distribution to the states in the first year exceeds the allocations for the program for the wives and infants of enlisted men (EMIC) by only $7,000,000. It is hard to see how a program for all the mothers and all the children in the country can be operated

with the funds suggested, even if the birth rate should decline in the years to come.

The National Mental Health Bill

The National Mental Health Bill (H.R. 4512), introduced by Representative Priest, supersedes an earlier bill, the National Neuropsychiatric Institute Act. Its objective is to amend the Public Health Service Act to provide for research relating to psychiatric disorders and to aid in the development of more effective methods of prevention, diagnosis and treatment of such disorders. The term "psychiatric disorders" includes diseases of the nervous system that affect mental health.

To carry out these purposes the bill proposes the authorization of four important policies. These are the allotment of grants-in-aid to universities, hospitals, laboratories and other public or private institutions and to individuals for such research projects as are recommended by the newly established National Advisory Mental Health Council; the construction and equipment of buildings and facilities to be known as the National Institute of Mental Health, which is to be part of the National Institute of Health; the admission and treatment at the institute of voluntary patients as well as patients of St. Elizabeth's Hospital, in Washington, D.C.; and the development of training and instruction in matters relating to the diagnosis, prevention and treatment of psychiatric disorders. Although nongovernmental institutions would play a large role in education and research, the National Institute of Mental Health would serve as a focal point for research, experimentation and advanced or specialized training, and as a clearing house for the collection and dissemination of information concerning advances in the prevention, diagnosis and treatment of psychiatric disorders.[2]

This program is to be administered by the Surgeon General of the United States Public Health Service at the federal level and by state mental-health authorities at the state level. The National Advisory Mental Health Council, consisting of the Surgeon General and six members, is created and is charged with the review and recommendation of research projects, the collection and publication of information on studies in the field of mental health and the recommendation of grants for training of personnel.

The bill proposes an initial appropriation of up to $4,500,000 for the building and equipment of the new institution and of a total of $11,000,000 for the current expenses of the program during the first year.

In December, 1945, the House committee reported favorably on the bill with the amendments.

There can be no doubt that this legislative proposal is a step in the right direction. One can only express the hope that it will be enacted and soon be followed by a bill for the improvement of facilities and services for persons with mental deviations. In many parts of the country such a service program lags behind the present knowledge of mental deviations and the methods for their proper treatment.

National Institute of Dental Research Bill

The National Institute of Dental Research Bill (S. 190), introduced by Senator Murray, is designed to provide for, foster and aid in co-ordinating research relating to dental diseases and conditions and to establish the National Institute of Dental Research. It authorizes federal grants-in-aid to the states for research in the prevention and control of dental diseases and conditions, as well as the establishment of a federal institute as part of the National Institute of Health, which will serve as a central research and training institution and a co-ordinating agency. Closely following the lines of other health bills, the measure vests the Surgeon General of the United States Public Health Service with administrative responsibility and creates the National Advisory Dental Research Council to review research projects, collect and publish pertinent information and review applications for grants-in-aid.

The initial appropriations for this program include up to $1,000,000 for the building and equipment of the institute and $730,000 for each fiscal year to cover the current expenses of the program.

Everyone who has carefully studied the many earlier surveys of mouth conditions and the recent findings made in connection with the Selective Service examinations is aware of the magnitude of the dental-health problem and will lend support to any proposal for intensive research. This purpose, however, is not served by the offer of several dissimilar proposals in different bills. There appears to be need for agreement on the policy to be pursued, as well as for concentration of legislative effort.

National Science Foundation Bill

The National Science Foundation Bill (S. 1720), introduced by Senator Kilgore, is a compromise bill succeeding the earlier Kilgore Bill (S. 1297) and the Magnuson Bill (S. 1285). One of its objectives is to advance the national health and welfare, and its general policy is clearly stated in the following words: "Full development and application of the Nation's scientific and technical resources is essential for . . . the national health and welfare."

Use of tax funds for the support of research by both governmental agencies and nongovernmental organizations is the core of the proposal. Of the total funds not less than 15 per cent are to be expended for research and development in health and medical sciences. These allocations are to supplement rather than supplant the functions or activities of other governmental agencies authorized to engage in scientific research and development. They are to be made for projects approved by the administrator and undertaken on behalf of the

National Science Foundation. Freedom of research and publication is assured by the provision that every effort is to be made to eliminate restraints on the free expression of scientific views and to ensure full freedom in the exercise of creative talents, in the development of new ideas and in the method of research. Any person engaged in such research and development activities is not precluded from discussing, writing or publishing his own findings and conclusions.

In addition to research, undergraduate and postgraduate education would be supported by tax funds. The bill contemplates an authorization to award scholarships and fellowships to persons for scientific study or scientific work at nonprofit institutions of higher education or other institutions, selected by the recipient of such aid, for such periods as the administrator may determine, in the United States or in foreign countries. With this the door to medical education is opened to many qualified students lacking the necessary financial resources.

To administer this program, the creation of a special central agency, the National Science Foundation, is proposed. This agency has a divisional structure and includes eight divisions, one of which is the Division of Health and Medical Sciences. The Interdepartmental Committee on Science is to correlate and appraise research activities of all federal agencies engaged in or concerned with this field.

Full-time administration of the foundation is the guiding principle of organization. A full-time administrator is to be appointed by the President by and with the advice and consent of the Senate. There is to be a full-time deputy administrator, appointed by the President, and full-time divisional directors and staff members, all appointed by the administrator. The National Science Board of nine members is established to advise the administrator on all matters of major policy or program or budget, and divisional scientific committees of not less than five and not more than fifteen members will serve the divisions in an advisory capacity. The members of the board, the divisional committees and the staff of the foundation are to be chosen without regard to their political affiliations and solely on the basis of their demonstrated capacity to carry out the purposes of the foundation and their fitness to perform the duties of their office.

The Kilgore Bill expresses the best scientific thinking, is drawn in conformity with the wishes of those interested in the promotion of unhampered research and deserves enactment. It has been passed by the two Senate committees concerned.

Research Provisions of the National Health Bill

The National Health Bill, or Wagner–Murray–Dingell Bill, in Title I includes research and the performance of demonstrations in the definition of public-health work; declares demonstrations to be part of the maternal and child health program and the services for crippled children; and requires the United States Children's Bureau to make and aid in the financing of such studies, demonstrations, investigations and research as will promote the efficient administration and operation of this part of the bill.

Title II, which deals with prepaid personal health service benefits, contains the following important section:

> For the purposes of encouraging and aiding the advancement and dissemination of knowledge and skill in providing benefits under this Act and in preventing illness, disability and premature death, the Surgeon General is hereby authorized and directed to administer grants-in-aid to nonprofit institutions and agencies engaging in research or in undergraduate or postgraduate professional education.

It is indeed gratifying to find so much emphasis placed on research, but it is disturbing to notice the absence of an over-all plan to correlate the various provisions scattered in many bills.

* * *

This presentation, intentionally limited to some of the major bills introduced in 1945, shows that there is a wave of enthusiasm for health legislation. Porter R. Lee[3] once wrote: "The crystallizing of enthusiasm into programs is a wholesome development. It betokens an awakened community alert to its social obligations; and an awakened community is a bulwark of progress. Moreover, concepts, ideals and enthusiasm are of little effect until they do crystallize into programs." We find ourselves in a situation that resembles what Voltaire called the "*embarras de richesse*" (the embarrassment of riches).

In deciding on the various legislative proposals, we are faced not so much with the problem of rejecting obviously inadequate measures as with the hard choice between good and better plans. Let us keep in mind that long-term strategy, rather than stopgap tactics, assures ultimate victory in the fight against disease, defect, human suffering and poverty. The question to be answered may be formulated as follows: Do we want piecemeal legislation, with its inevitable result of fragmentary and unequal development, or comprehensive health legislation, with its promise of substantial achievements throughout the country? The issue is well stated in a recent report of the United States Public Health Service: "The Nation cannot afford to be content with less than a comprehensive program — a program to apply throughout the length and breadth of the land, in every community, all the knowledge we have for prevention of disease, the relief of suffering and the promotion of health."[4]

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MEDICAL PROGRESS

NORMAL GROWTH AND DEVELOPMENT DURING ADOLESCENCE (Concluded)*

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BOSTON

ADOLESCENT CHANGES IN PHYSIOLOGIC FUNCTIONS

Basal Metabolism

There is of course an increase in the number of basal calories consumed per hour by the body as it increases in size year by year, and this is greater during pubescence than previously because the body size is increasing more rapidly. There is, however, less clear evidence regarding any fundamental increase in the basal metabolic rate associated with pubescence that is not explained on the basis of increased amount of active protoplasmic tissue.

In a comprehensive study of basal metabolism in girls, Talbot, Wilson and Worcester[45] in 1937 investigated the effects of pubescence on these rates. They concluded from a review of all data that an elevation of the heat production of girls tends to start at about ten years of age and reaches its maximum at the menarche, but that this rise is not a constant finding and that puberty per se cannot be considered the causative factor. They believed that there was sufficient evidence that the increased rate of growth in height during this period was the primary factor. Nylin[46] expressed the same opinion in 1935. Shock[47] has presented a curve for the basal heat production of girls in relation to the menarche, expressed as calories per square meter of surface area per hour. This shows a slight rise in the two and a half to three years before the menarche, an absence of change to the menarche and a continuing decline during the first three years thereafter. This period of rapid fall is more closely associated with the menarche than with any particular age. Webster, Harrington and Wright[48] report thorough longitudinal studies of basal metabolism in a few boys and girls over these years and discuss the changes in relation to growth and development. Johnston[49, 50] made closely repeated determinations of metabolic rates in girls during the year of the menarche. He found them markedly unstable at this time, with a tendency to high rates just before the menarche and lower rates shortly after it.

Lewis and his associates[51, 52] have conducted extensive longitudinal studies of basal metabolism in children up to fifteen years of age and have provided valuable tables of norms for sex and age. They failed to establish any absolute increase during pubescence in the mean basal metabolism expressed as calories per square meter per hour. They point out, however, that during the ages of eleven to fifteen years in boys and ten to twelve years in girls, the rate of fall is greatly diminished in comparison with that in the preceding years, being only one quarter of the earlier rate in boys and one half of it in girls. They interpret this as indicating a relatively increased metabolism during pubescence. Talbot and his associates[45] considered the possibility that the enlargement of the thyroid gland that often occurs at this time might be responsible for an increased metabolic rate, but they concluded that the evidence does not point to any such relation. They found no trend toward an elevated pulse rate at this period that could account for an increased metabolic rate, but Shock has since reported a rise of ten points in the average pulse rate in girls during the pubescent period.

There is general agreement that following the menarche in girls and maximum growth in boys the basal oxygen consumption falls sharply during the first year and to a lesser amount in the next two to five years. Talbot et al. state that between the menarche and the age of fifteen and a half years in girls the rate falls about 5 per cent below the average trend. Shock compared the curves of absolute oxygen consumption for early maturing girls and boys with those for late maturing groups. The boys had a higher average rate than the girls on an age basis, but the curves for both groups showed the same steady postpubescent decline. They became more uniform when plotted against the menarcheal age for girls and the maximum growth age for boys than when plotted against chronological age.

There appears to be some disagreement on the question whether the basal metabolic rate is most advantageously expressed in terms of surface area, height or weight. Talbot[53, 54] recommends that it be expressed in terms of urinary excretion of creatinine. His reason is that this excretion is a function of the amount of muscle in the body and that muscle is the principal active protoplasmic tissue. Since it is peculiarly difficult to interpret basal metabolic rates during adolescence because of the great normal variability and the many factors concerned in determining any given rate, it seems especially desirable to use several methods of expression and to consider the values obtained by each method in respect to appropriate norms. So far as possible the develop-

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mental age should be taken into account as well as the chronological age. The various tables of values published in the references cited are especially useful for this purpose.

Although the evidence concerning the nutritional requirements during the adolescent years is not reviewed in this report, it is of interest to call attention to the changes in the caloric values of the diets consumed by adolescents during the years in which the basal consumption is changing in the manner described.

If one considers the basal calories in relation to total caloric intake at the beginning and at the end of pubescence, a suggestion is given of the differences between boys and girls at these periods in muscle mass, which primarily determines normal basal calories, and in physical activity, which is one of the major variables that contribute to the differences between basal and total calories. The tables presented by Lewis[6] show that for girls of ten to eleven years of age the average caloric consumption per hour is 49.3, or 1183 a day. Wait and Roberts[55] estimate that at ten years the average total caloric intake of girls is 2100. Lewis's tables give values for average basal calories for boys of twelve to thirteen years as 53.5 an hour or 1284 a day, and the best estimate of total caloric intake for boys at twelve years appears to be 2600 calories. Thus, at the age of onset of pubescence, when body size is much the same in both sexes, the basal caloric consumption of boys is about 10 per cent greater than that of girls, whereas the total calories taken are nearly 25 per cent greater. The same data for the end of pubescence are as follows. Between the ages of thirteen and fourteen the basal caloric consumption of girls is given as 56.5 an hour or 1356 a day, and the total calories consumed at thirteen years as approximately 2600. The corresponding figures for boys aged fifteen to sixteen are 64.0 an hour or 1536 a day, and the total calories at fifteen years in the neighborhood of 3500. Thus, at a comparable stage of late pubescence, but with boys on the average considerably larger than girls, the basal caloric consumption is nearly 15 per cent greater in boys than in girls and the total calories consumption is about 25 per cent greater.

Wait and Roberts found that the largest increase in the average total caloric intake occurred in the thirteenth year, during which the average girl is accomplishing her maximum growth. These authors call attention to the great variability both in the number of calories consumed by children of the same age and in the day-to-day intakes of the same children. When one considers that caloric needs are principally determined by basal needs, together with the amount of muscular activity, and that basal needs are largely influenced by size and particularly amount of muscle, these age and sex differences are quite understandable. They should all be taken into account both in interpreting basal metabolic rates and in considering dietary needs during the adolescent years.

Calcium and Nitrogen Retention

Johnston[56] has published several studies of calcium and nitrogen retention during the adolescent years under various circumstances. In this connection he has brought out several interesting relations between glandular activity, appetite and growth. High retention of calcium and nitrogen tend to occur just before the menarche and a sharp fall takes place immediately thereafter. This rise and this fall, however, sometimes precede and sometimes follow the first period. Estrogenic substances administered to normal girls at puberty depress calcium balances and occasionally nitrogen balances as well. Johnston concluded from studies of normal and abnormal thyroid function and thyroid therapy during adolescence that optimum retentions of calcium and nitrogen occur when metabolic rates are elevated within the normal range but not excessively stimulated.

Other Physiologic Activities

Most of the physiologic processes that are unassociated with sexual development or with the basic endocrine activities related to sexuality have become well stabilized before adolescence, and relatively small changes take place in them during the latter years of growth.

Shock[47] has obtained physiologic data based on studies of 50 girls every six months from the ages of twelve to eighteen years, with the age at the menarche known, and has plotted them on a menarcheal-age basis. These include pulse rates, systolic and diastolic blood pressures and pulse pressures, and basal respiratory volumes. His studies show that on the average among girls the systolic blood pressure rises steadily during the three years preceding the menarche — from 97 to 107 mm. — and remains at about the latter level during the ensuing five years. The diastolic pressure shows no constant change during either period. Hence, there is a net increase in pulse pressure during the premenstrual period, with little change thereafter. The average pulse rate shows a rise from 63 three years before the menarche to 73 one year before it and a slight drop to 70 at the menarche. The pulse falls further to 65 in the first three years and to 60 in the next two after the menarche. The basal respiratory volume expressed as liters per minute rises sharply in the two or three years before menarche — from 3.2 to 4.7 liters — and remains constant thereafter, but expressed as liters per square meter of body surface area per minute it presents an early rise followed by a gradual fall. Thus, in all these measurements except diastolic pressure there appears to be an increase during pubescence in girls.

In another publication, Shock[57] presents norms for 50 adolescent boys and 50 adolescent girls on a

chronological-age basis from eleven and a half years to seventeen and a half years. The principal sex difference appears to be that after fourteen years of age the average systolic pressure and pulse pressure are considerably higher for boys than for girls. Graham[58] also presents figures for blood pressures based on repeated determinations in 3580 children, from which he secured modal values as well as variability values with age. Variability tended to increase with age but was more pronounced among girls between ten and thirteen years old than among boys of the same age range. The tables presented by Richey[59] giving blood-pressure values by age also serve as useful reference standards. Graham reviews the relations between blood-pressure levels, body size and physical maturation.

The changes in blood cytology have been studied by Osgood and Baker[60] up to thirteen years and by Mugrage and Andresen[61] for the same period. These changes are not of sufficient magnitude to deserve description here, but the tables presented by these authors serve as valuable reference standards for the early years of adolescence. The values given for thirteen years appear to be near the adult values for women, although the hemoglobin and red-cell values are somewhat below those for men.

The Endocrine Glands

It has been recognized for many years that the processes of growth and maturation are influenced by, if not completely under the control of, hormones secreted by several of the endocrine glands. Extensive research during recent years, based largely on animal experimentation but supplemented by studies of grossly abnormal children and the clinical use of endocrine products, have done much to clarify understanding of the mechanisms involved. More recently the development of methods for determining the amounts of certain hormones excreted in the urine of normal as well as of abnormal children has especially helped to confirm certain hypotheses regarding the endocrine activities associated with growth and maturation during adolescence.

It is not within the scope of this report to review the extensive literature in this field. The reviews prepared by Aldrich[62–64] several years ago are still useful for background. There is now in press a clinical review by Talbot and Sobel[65] that considers the more recent evidence concerning the endocrine factor, as well as other factors that determine growth. A few recent studies of the urinary excretions of certain hormones by normal children year by year during adolescence are so pertinent to the subject of this report that the findings will be reviewed.

The glands known to be involved in the developmental changes occurring during adolescence are the thyroid, the pituitary, the adrenals and the gonads. The thyroid gland is included because of its known relation to basal metabolism and to osseous development and because there is a tendency for it to hypertrophy during adolescence. The participation of the thyroid in the complex glandular interrelations that constitute the mechanism controlling adolescent development does not, however, appear to be a major or direct one. It has been pointed out that the differences in basal oxygen consumption, which should reflect changes in thyroid activity, are primarily related to body size and muscle mass and that age differences in basal metabolic rates corrected on this basis are not consistently different to any significant degree. The determination of blood iodine levels as an index of thyroid activity appears to have value principally in dealing with diseased persons. In some series of reported cases considerable enlargement of the thyroid gland has been found to occur during pubescence in a large proportion of cases, but this does not appear to be uniformly true in all localities. Pryor[34] examined 74 girls in San Francisco at the time of onset of the menses and reported slight enlargement in 16, moderate enlargement in 47 and definite lateral enlargement of both lobes in 10, with only 1 girl showing no enlargement. I have, however, found enlargement in only a small proportion of the children studied in Boston, and in these cases it was of slight degree.

The relation of the thyroid gland to epiphyseal growth and the steps leading to union with diaphyses is well known. The rate of maturation in these locations is unquestionably influenced by the drug thyroid, and normal thyroid function is necessary for normal osseous development. The pituitary and possibly other glands play a part in regulating this process, and its continuance to the point of union of epiphyses with diaphyses ultimately leads to the cessation of growth. It does not, however, appear that any sudden change in thyroid activity is responsible for the termination of growth or for any of the specific changes associated with pubescence or postpubescence.

The glands that are of special interest in this connection are the pituitary, the adrenals, the ovaries and the testes. The interactions of the hormones elaborated by these glands appear to be responsible, in large measure at least, for the progressive stages of adolescent development that have been described. The anterior lobe of the pituitary gland is known to elaborate several hormones, among which the growth hormone, the gonadotropic hormone—of which there are two or more fractions, follicle-stimulating and gonadotropic—and the adrenocorticotropic hormone have been most thoroughly studied. It appears that an increased secretion of the growth hormone is primarily responsible for the general acceleration of the rate of growth of the body as a whole and that a decrease in this secretion, probably brought about by action of the gonads, accounts in part for the sudden deceleration in growth. This conclusion is based primarily on studies showing that in its ab-

sence growth does not occur and that with excess secretion general uniform overgrowth takes place.

The initial stages of sexual differentiation, especially of the growth of the gonads, are believed to result from an increased production of the gonadotropic and adrenocorticotropic hormones, the former probably acting directly and the latter indirectly by stimulating the androgenic zones of the adrenal glands. Lack of these hormones during the prepubescent period results in some degree or type of hypogonadal state. An excess of these hormones prior to puberty produces manifestations of p ecocious sexual development, with or without early reproductive capacity. Some of these deviations from the normal may also occur as a result of abnormal levels of secretion of the specific part of the adrenals referred to, owing to disease in these glands.

The gonadotropic hormone is excreted in the urine, and repeated quantitative determinations have been made throughout adolescence on twenty-four-hour specimens of urine in several groups of normal boys and girls. The reports of Nathanson, Towne and Aub[66] on studies at Harvard and of Dorfman, Greulich and Solomon[67] on studies at Yale are of particular interest. These indicate that the gonadotropic hormones — measured by Nathanson as the follicle-stimulating hormone (F. S. H.) and by Dorfman as gonadotropin — do not appear in measurable quantities in girls until eleven years of age or in boys until thirteen years. Excretion of the hormones increases rapidly in amount after their first appearance, and this increase coincides with the dramatic increase in the hormones from the peripheral sex glands. Nathanson et al. point out that the secretion of the follicle-stimulating hormones probably precedes that of the gonads, but that the methods available for their assay at the time of the study were not sufficiently precise for their presence to be recognized in their initial small concentrations.

Estrogens are the female sex hormones, which are probably produced both by the adrenal glands and by the ovaries, and androgens are the male sex hormones, measured as the 17-ketosteroids and produced both by the adrenal glands and by the testes. According to Nathanson, Towne and Aub, estrogens and androgens are both present in both sexes in fairly constant but negligible amounts between three and seven years of age. The amounts of these excreted in the urine increase moderately and to a like degree in girls and boys between seven and nine years, the 17-ketosteroids on the average being slightly higher in boys and the estrogens in girls. Between nine and eleven years the 17-ketosteroid excretion increases more rapidly in boys and the estrogen excretion in girls, but individual differences are extremely wide. During the twelfth year on the average, but sometimes earlier, a cyclic variation in output of estrogens by girls becomes obvious, with wide differences between the peaks and minimum values in single cycles. The average values continue to rise in girls after eleven years, whereas the output of estrogens by boys remains relatively constant. During this same period boys excrete increasing quantities of the 17-ketosteroids, but the difference between the sexes in the excretion of androgens is not nearly so marked as that of estrogens becomes.

Nathanson and his co-workers conclude that there is a primary stimulation of the gonads and adrenal glands that causes a steady — noncyclic — increase in both androgens and estrogens in both sexes. The high values and cyclic excretions of estrogens occurring in girls result from a superimposed stimulation— presumably of the ovaries by the pituitary gland after the former have matured sufficiently to excrete quantitatively. Similarly, the high urinary values of the 17-ketosteroids occurring later in boys are thought to be the result of an added excretion from the maturing testes. Thus, the gonadotropic hormones of the pituitary apparently first stimulate the adrenal cortex to increased but steady excretion of 17-ketosteroids and estrogens. At the same time they stimulate the growth and maturation of the testes and ovaries and later stimulate these organs to hormonal activity. This causes a higher but relatively steady excretion of androgens by boys and a much higher and cyclic excretion of estrogens by girls, thereby leading to the ultimate marked differences between the sexes in the amounts of these hormones found in the urine.

Talbot et al.[68] have also studied the excretion of 17-ketosteroids in relation to age and have emphasized that the amounts recoverable from the urine before ten years are negligible. They also found that little sex difference is discernible until fifteen years of age and that the output by boys increases up to eighteen years of age at least. It should be pointed out, however, that it has not been demonstrated that the gonads themselves secrete any hormones that affect the development of the sex organs or sex characteristics prior to the pubescent period. Moore[69] has reviewed the evidence relating to the gonads during embryonic and prepubescent life, and concludes that they do not secrete hormones that affect sex-organ development during these periods. In considering the relations between the levels of these excretions and the physical changes associated with adolescence, the following observations have been made. First, the simple linear elevations in these excretions have progressed for several years, probably three or four, before the first clinical signs of sexual differentiation appear. This covers the period that I have referred to as prepubescence. Second, the sudden sharp rise of estrogens in girls, which precedes by a short interval the development of cyclic variations, is closely associated with the early physical changes of pubescence and rapid growth of the ovaries and may be said to mark the beginning of the pubescent period. Cyclic variations in excretion of estrogens are apparently taking place

during much of the pubescent period in girls — that is, for a year or more prior to the menarche. It is therefore consistent with these occurrences to postulate that the ovarian follicular hormone is necessary before cyclic excretions can begin, and that under this stimulation uterine development must have progressed sufficiently before the menstrual cycle can be completed. The menarche thus follows a period of several years of gonadal endocrine development. Third, the first sharp increase in the excretion of 17-ketosteroids in boys is associated with rapid growth of the adrenal glands and precedes that of rapid growth of the testes. A further increase is associated with rapid growth of the testes and appearance of the secondary sex characteristics. This association of events lends support to the presumption that the former is primarily of adrenal origin and the second of testicular origin. Lastly, the shift from neuter configuration to greater differentiation in physical characteristics accompanies the changes in the levels of these hormonal excretions. Nathanson and his associates[70] have reported a correlation of 0.8 between excretion of 17-ketosteroids and that of urinary creatinine in both boys and girls. Since the latter is a function of muscle mass, androgenic excretions are presumably closely correlated with amount of muscle. The greater development of muscles in boys over girls actually occurs during the years when the excretion of androgens is becoming markedly greater in boys than in girls. Both Nathanson and Dorfman have found that the individual variability in the excretion levels of these hormones is to some extent correlated with the physical development of the subjects.

With several hormones being produced and interacting on each other, the variations in the timing, character and magnitude of adolescent growth and sexual differentiation are readily understandable. Furthermore, with the production of both male and female sex hormones by both sexes, and in different amounts between individuals, various degrees of femininity in boys and masculinity in girls are to be expected. In considering many of the variables in both sexes, as, for example, late development in girls with broad shoulders, narrow hips and considerable body hair as contrasted with early development in boys with broad hips, narrow shoulders and sparse body hair, differences in the balance of the sex hormones from the usual occurrence may be assumed. Nathanson and Aub cite an example of striking change from obvious feminine identification in 2 boys toward masculinity associated with a rise in the androgen-estrogen ratio from estrogen excess to androgen preponderance. Further studies are required to demonstrate the relations between individual variability in hormonal excretions and growth and maturation.

Factors Contributing to Group Differences in Growth and Development of Normal Adolescents

A better understanding of the normal physical and physiologic changes of adolescence, and particularly of the variability in their manifestations, which is consistent with good health and satisfactory ultimate development, would undoubtedly lead to more rational management of many of the so-called "problems of adolescence." It is not suggested that these problems do not require attention, but rather that the recognition that they are in many cases essentially physiologic would result in more conservative therapy and in greater emphasis on hygienic living. Frank[71] has called attention to some of the implications of what is known about growth and development during the adolescent years in respect to the policy and program of care for adolescents from a health standpoint. Shorr[72] approaches such endocrine problems from this point of view and has discussed the management of the usual ones. He takes the position that most of these can best be handled by a sane program of physical and mental hygiene, planned from the point of view that they are in the main expressions of physiologic variations.

It is now fully established that hormones elaborated by the endocrine glands are primarily responsible for the events that have been shown to occur in connection with the progress of a child toward maturity. Nevertheless, it is of interest to consider what conditions may lead to variations in hormonal activities and hence to differences between individuals or groups during this period. Since this report is concerned with normal occurrences, the effects of congenital abnormalities, defects, accidents and disease will not be considered.

Racial and familial traits have long been recognized as important predeterminers of group as well as of individual characteristics. The extensive literature bearing on these hereditary factors cannot be reviewed here, but it is clear that any effects brought about by environmental factors can operate only within the limitations imposed by the genetically determined qualities and potentialities of the initial germ plasm. Boas[73] devotes much attention to the parts played by heredity and environment in bringing about family and racial differences. He has found that certain traits, such as the form of the head and face, are much more strongly influenced by race or family pattern than are others like height and weight. From statistical analyses of extensive studies, however, he concludes that even facial characteristics are modified by changes in environment. Hence, it is unwise to assume that any physical attribute is entirely determined by heredity or cannot be modified by environment. In clinical practice it is important to recognize individual characteristics that are constitutional in character and that may impose physical limitations or lead to ex-

treme deviations in physical status or growth progress. A carefully taken family history often makes it appear that these are intrinsic in nature, but this conclusion cannot be accepted until a careful investigation of environmental factors has been carried out and a serious effort has been made to correct unfavorable influences. It is also unsafe to compare two racial groups of children and to conclude that any differences found to exist between them are racial in origin. Several recent studies offer strongly suggestive evidence that dietary habits or factors associated with socioeconomic circumstances may have more to do with the differences found to exist between racial groups than has the factor of race itself.

Some writers have stressed the differences in size and build and rate of maturation between groups of children living under different climatic conditions, but here again one must be cautious in accepting climatic factors as responsible unless racial differences on the one hand and socioeconomic differences on the other have been taken into account. Mills[74] has brought together considerable evidence in support of a climatic effect. This evidence deals not only with the average age of the menarche and with the rates of growth of children in different climates but also with these differences in animals reared in different atmospheric conditions. Mills states that in regions of depressing moist heat, both growth and the menarche are delayed and the final adult form is slender and small, whereas growth and pubescent development are most accelerated and the most robust body forms are seen in the stimulating, stormy temperate regions. He has obtained exactly similar differences in laboratory animals, where ease or difficulty in loss of body heat was the experimental variable.

Michelson[75] has attempted to determine whether differences in the age at the menarche between Whites and Negroes are attributable to race or socioeconomic circumstances. He studied twelve separate population groups and showed that Negro girls born and living in the West Indies reached the menarche on the average at 13.99 years, those in the southern part of the United States did so at 13.68 years, those in New York State at 12.94 years, and a small well-to-do group in New York State at 12.85 years. White girls born and living in New York State reached the menarche on the average at 12.86 years. Although the average age at the menarche for all Negroes is considerably later than that for Whites, this breakdown into groups makes it seem extremely doubtful that race per se is primarily responsible.

Other students have reported differences in menarcheal ages for different socioeconomic groups, with very late occurrence among girls in the less favored groups. Larger samples and better selected groups must be studied, however, before the influence of socioeconomic factors can be considered to have been established. The same may be said of the recent reports from Europe to the effect that girls are now menstruating about one year later than was previously usual in countries subjected to severe dietary restrictions and other socioeconomic stresses during the recent war. The accumulating evidence suggests strongly, however, that prolonged undernutrition, especially in calories and protein, may retard maturation as well as physical growth. This is not surprising in view of the fact that chronic starvation leads to amenorrhea in women and to loss of the secondary sex characteristics in both men and women.

Meredith[76–78] has reviewed the evidence concerning the effects of race, region and socioeconomic factors on the height and weight of children. Using the Harvard Growth Study data, he compared children born and living in Massachusetts of North European ancestry with those of Italian ancestry in respect to stature. The former exceeded the latter at all ages from seven to seventeen years in both sexes. The increments of gain year by year were not significantly different during this period, however, the racial difference having been established by seven years, the earliest age studied.

In another study based on more than 60 samples of boys between the ages of nine and fourteen years representing differences in race, class, time and region, Meredith found that boys in the United States of various ethnic groups, otherwise roughly comparable, differ in average height between groups up to a maximum of 5 cm.; that white boys residing in different parts of the United States vary little in average height and weight; and that white boys of the professional and major managerial classes are taller and heavier than those of the unskilled and semiskilled classes, the differences not exceeding 3 per cent for stature and 6 per cent for weight.

Meredith's most interesting findings have to do with a striking secular trend over the last fifty years. His analysis of the measurements obtained in Toronto school children in 1892, 1923 and 1939 are of particular interest. The typical Toronto boy aged thirteen to fourteen years was taller in 1939 than was the boy of 1892 by nearly 9 cm., and the typical boy of 1923 was about midway between. The differences at all ages were in the same direction, although of less marked degree. Meredith also finds that boys in the United States today, both White and Negro, are 6 to 8 per cent taller and 12 to 15 per cent heavier than were boys half a century ago. In general, secular differences in the United States covering the last half-century are twice as large as any of the other differences considered, whereas geographical differences are the smallest of all. Several studies of the heights of college boys in recent years and of their fathers while in college, and similarly of college girls and their mothers a generation ago, have revealed a considerable increase indicative of a secular trend. The causes for these evidences of increasing size with time call for further

study, but they are doubtless related to differences in the incidence of illnesses in early life, to dietary habits, to habits of activity and to other more obscure factors generally referred to as socio-economic.

The physician dealing with a child who is undersize or otherwise underdeveloped cannot determine to what extent these features are due to heredity and to what extent to faulty diet or hygiene or to disease. If one or both of the child's parents show similar characteristics, the physician may be tempted to accept a genetic explanation as fully satisfactory without appreciating that in all probability environmental factors have played some part and possibly a dominant one. His assumption in itself tends to block further study and to keep him from devoting attention to diet and hygiene. It appears to be a more rational approach, and certainly one more in accord with recent findings, to assume that both hereditary and environmental factors are operative to some extent in all cases. Hence, heredity should never be accepted as the sole or even the principal factor in a given case until a thorough investigation has failed to reveal other retarding influences, or until correction of faulty environmental influences has been accomplished to the fullest possible extent.

Medical supervision of the care of infants and young children has unquestionably contributed greatly toward better health and development during these early years. This has been made possible by intensive study of the normal course of events as well as of the special problems at these ages. Medical supervision during the adolescent years can undoubtedly contribute much toward better health and more generally satisfactory development during this period also, and hence toward a higher standard of physical fitness at maturity. This progress, however, is dependent on further research and a better understanding of the normal course of events and the special problems of these years.

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CASE RECORDS OF THE MASSACHUSETTS GENERAL HOSPITAL

Weekly Clinicopathological Exercises

FOUNDED BY RICHARD C. CABOT

TRACY B. MALLORY, M.D., *Editor*

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CASE 32221

PRESENTATION OF CASE

A fifty-three-year-old Navy veteran entered the hospital because of dysphagia.

The patient was apparently well until three years before admission, when his ship was torpedoed. Thereafter he became quite "nervous." Four months before entry, he noted during luncheon the sudden onset of inability to swallow. He continued to have similar attacks several times a month, but they occurred only during periods of nervous excitement. During an attack a piece of solid food would "get caught in the neck"; it was usually vomited immediately, but occasionally it was swallowed. Once the first solid food had passed, the remainder of the meal followed fairly readily. He had little trouble with liquid or soft foods. One month before entry, the patient vomited some bloody material while waiting in the Out Patient Department. He was immediately admitted to the Massachusetts Eye and Ear Infirmary, where a barium swallow showed a questionable lesion of the lower end of the esophagus. A chest film was normal. An esophagoscopy showed injection of the mucosa and engorged vessels near the cardia, and the operator gained the impression that a hard mass was pushing the esophagus forward, thus narrowing the lumen; no ulceration was seen. A biopsy specimen from this region showed slight chronic inflammation and edema. Examination of the blood showed a red-cell count of 2,530,000, with 8.6 gm. of hemoglobin, and a white-cell count of 5800, with 57 per cent neutrophils. He was then discharged to the Out Patient Department.

He did well at home, eating everything, including hard biscuits, and gaining a few pounds in weight. Two weeks before entry he was again seen at the Eye and Ear Infirmary for a repeat esophagoscopy. The findings were identical with the previous ones. A No. 22 bougie passed the lower third of the esophagus with difficulty. The biopsy specimen showed acanthosis, slight chronic inflammation and edema. A barium swallow was reported as indicating some esophageal obstruction. A gastrointestinal series revealed a constantly deformed duodenal cap, but no ulcer crater was demonstrated. Examination of the blood showed a red-cell count of 3,720,000, with 10.5 gm. of hemoglobin, and a white-cell count of 6600.

Two days before entry, the patient was unable to swallow even milk "because of nervousness." Afterward he was able to eat a full meal. The patient stated that he lost 20 to 30 pounds in weight during the four months before admission. He gave no history of epigastric distress, intolerance to fatty foods, jaundice or melena.

Physical examination revealed a somewhat emaciated man who was in no acute distress. The heart was normal. A few crackling rales were heard at the bases of the lungs. The abdomen and extremities were negative.

The temperature, pulse, and respirations were normal. The blood pressure was 130 systolic, 78 diastolic.

Examination of the blood revealed a red-cell count of 4,000,000, with 70 per cent hemoglobin, and a white-cell count of 7900 with 57 per cent neutrophils. The total proteins were 6.3 gm. per 100 cc., and the chloride 104 milliequiv. per liter. The urine was normal. The stools were brown, and one of two specimens gave a positive guaiac test.

X-ray examination of the chest showed no abnormality. Another gastrointestinal series revealed no difficulty in the act of swallowing. The esophagus showed some tubulation of the lower 2 or 3 cm. and an apparent soft-tissue thickening just about the cardia. Small soft-tissue masses seemed to project into the gas bubble, and barium was seen to "squirt" from the cardia across the gas bubble. Fluoroscopically the stomach appeared normal, with the exception of considerable thickening of the gastric rugae. On the film, however, there was questionable rigidity on the cardiac side of the fundus. The duodenal cap was again constantly irregular and deformed; it also showed an irregular fleck in the center of the cap measuring about 0.5 cm. in diameter. The upper small intestine was not remarkable.

Two additional esophagoscopic biopsies showed acute and chronic inflammation. On the fifteenth hospital day an operation was performed.

DIFFERENTIAL DIAGNOSIS

DR. EARLE M. CHAPMAN: May we see the x-ray films?

DR. JAMES R. LINGLEY: These films of the lower esophagus show the rigidity and irregularity that was referred to in the summary and, in addition, a suggestion of a mass above the cardia pressing on the gas bubble of the fundus. The same thing is seen in this film, a soft-tissue mass projecting into the fundus of the stomach. In this view, taken in the upright position, the barium seems to swerve across the base instead of passing along the lesser curvature

as it normally does. The film of the chest shows a normal heart and lungs, but it suggests a mass in the region demonstrated in the gastrointestinal film. I think that the observation of an ulcer crater in the duodenum must have been that of the fluoroscopist. The films show deformity but no definite crater that I can make out.

DR. CHAPMAN: It seems obvious to me that we are dealing here with evidence of a tumor of the stomach, and so it comes down to a question of type. Was it a benign tumor or a malignant tumor? If we paraphrase the history, briefly, we have a man of fifty-three who suddenly had difficulty in swallowing, vomited blood, had an anemia, had lost a good deal of weight, had guaiac-positive stools and had a mass in the fundus of the stomach; it is a temptation to make a diagnosis of malignant tumor, which would be a sound clinical diagnosis.

On analysis of some of the clinical features in this case, however, I rather favor the possibility that this lesion was some benign condition. So we have to think of the benign lesions that can produce this syndrome in a man of fifty-three. To begin with, we have the fact that he had been nervous and emotionally upset. He then had what sounds like a typical description of cardiospasm, because although at times he could swallow solids and fluids, at other times, after being emotionally upset, he could not even swallow liquids. Another strong clinical point is the absence of pain. Carcinoma usually produces pain, but we do know that about 10 per cent of such patients may be without pain, and in Osler's[1] original series of 160 patients with extensive carcinoma of the stomach, 20 had no pain. Another clinical point is the improvement in the anemia, which is unexplained. When the patient first came in he had a red-cell count of 2,500,000, but later, just before operation and I judge without transfusion, the count was 4,000,000, with a hemoglobin of 70 per cent. That is another point against a malignant lesion. The third clinical point against a malignant lesion is that the rugae were thickened and that a duodenal ulcer was present, a combination that is most unusual in a person with carcinoma higher up. The association of duodenal ulcer and cancer of the stomach is quite rare.

If it was a malignant lesion, what type could it be? In this region it should be the medullary type, a large cauliflower-like growth that invades all layers of the stomach and produces villous-like projections into the stomach. It can produce the picture that Dr. Lingley has described, but this man was operated on and apparently did not come to autopsy, and I have a hunch that he is still alive. If it was a medullary carcinoma, he might have had metastases in the lungs, and yet there is no evidence of metastases in the chest films.

If it was a benign lesion, what type could it be? There are several types of benign tumors of the stomach. One is a bezoar, sometimes found in nervous people. I cannot believe that a bezoar would do this, nor can I believe that this was one of the rare types of tumor, such as myxoma, fibroma or a cystic tumor. One tumor that falls midway between the extremely malignant and benign forms is lymphoma. It is too bad that we do not have a complete blood picture, although I do not believe that a differential count would have substantiated a diagnosis of lymphoma.

There is one other type of benign tumor that this might be, that is, a so-called "polypoid adenoma," which is seen in older people in the presence of gastritis. In Winternitz's[2] case there were multiple tumors not only in the stomach but throughout the intestine, and also multiple skin tumors of the hemangioendothelioma type. I looked carefully to see whether skin tumors were described on physical examination, but none were reported.

The biopsy diagnosis of acanthosis is a puzzling point.

DR. MALLORY: Leukoplakia might have been a better word to use — and a more familiar term.

DR. CHAPMAN: The word acanthosis made me think of a rare skin condition known as acanthosis nigricans, which is often associated with cancer of the stomach, but the clinical record gives no indication of skin pigmentation, so that acanthosis nigricans is unlikely.

Finally, because of these four clinical points — the absence of pain, the improvement in the anemia, the presence of a duodenal ulcer and the existence of cardiospasm without proof of carcinoma from four esophagoscopies — I am going to say that this patient had a polypoid adenoma of the stomach.

I have one other comment to make. Here is another case in which the endoscopist and the roentgenologist have not been able to make a positive diagnosis. I think that that is chiefly because of the mechanical difficulties consequent to the location high in the fundus, where examination is difficult.

DR. TRACY B. MALLORY: Dr. Benedict, you esophagoscoped this patient. Let us hear your views.

DR. BENEDICT: I do not agree with Dr. Chapman in two respects. First, he says that cancer of the stomach is usually a painful process. There is no pain whatever in many cases of cancer of the stomach. Second, I think that the x-ray interpretation was of great help in this case. Dr. Lingley has just described a rigid terminal portion of the esophagus, with, I think he said, a mass infiltrating the fundus of the stomach. To my mind, that is fairly typical of carcinoma arising in the stomach and infiltrating the lower esophagus. I had made up my mind to that before Dr. Mallory showed me the record.

I did an esophagoscopy on this man twice, and both times I met complete obstruction at the cardiac orifice. I then tried to pass the gastroscope, but it also met complete obstruction. When the gastroscope meets complete obstruction at the cardiac orifice it usually means cancer. I did get biopsy

specimens, and both of them were negative, but I thought from the whole picture that the patient had a carcinoma of the cardiac orifice and that he should be explored by the transthoracic route, with a preoperative diagnosis of carcinoma.

DR. LINGLEY: I also disagree with Dr. Chapman. I wonder what type of benign tumor can involve both the esophagus and the stomach. By x-ray there is definite involvement of the esophagus.

DR. CHAPMAN: I got the impression in reading the description that a mass was pushing the esophagus aside.

DR. LINGLEY: That was by esophagoscopy.

DR. CLAUDE E. WELCH: Two or three of our resected stomachs every year show evidence of duodenal ulcer when the primary lesion is a cancer of the stomach.

CLINICAL DIAGNOSIS

Carcinoma of the stomach.

DR. CHAPMAN'S DIAGNOSES

Cardiospasm.
Polypoid adenoma of stomach.
Gastritis.
Duodenal ulcer.

ANATOMICAL DIAGNOSIS

Carcinoma of cardia of stomach, with periesophageal extension.

PATHOLOGICAL DISCUSSION

DR. MALLORY: This patient was explored by the transthoracic route. A gastrectomy was performed, the resected specimen including the lower portion of the esophagus. A scirrhous carcinoma of the cardia was found. This had invaded upward in the outer wall of the esophagus, narrowing it from external pressure without growing out into the mucosa of the esophagus at any point. So it is natural that Dr. Benedict's biopsy specimens did not show tumor. They had not gone deep enough, and should not have gone deep enough, to reach this tumor in the outer layers of the esophageal wall.

DR. CHAPMAN: Is that not a rare location for a scirrhous type of carcinoma?

DR. MALLORY: They are much less frequent in that area than in other parts of the stomach.

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CASE 32222

PRESENTATION OF CASE

First admission. A fifty-five-year-old liquor dealer entered the hospital because of weakness and tarry stools.

The patient was in apparent good health until one year before entry, when he had an episode of pain and weakness in the left lower quadrant of the abdomen. X-ray films taken at that time showed no abnormality. He recovered completely. Five months before entry, on his return home after a hard day in his store, he suddenly felt "sick at his stomach" and fainted following urination. Afterward he felt very weak and passed some tarry stools. A local doctor called the next day and found a marked anemia. Another gastrointestinal series was negative. The patient gradually regained full strength but continued to pass occasional tarry stools. Ten days before entry the patient had another episode of weakness followed by tarry stools mixed with gross blood. The patient had suffered from gout for many years.

Physical examination revealed a well developed man in no acute distress showing marked pallor of the skin and mucous membranes. The lungs were clear. A soft systolic murmur was heard at the apex. There was some tenderness to deep palpation in the left lower quadrant. Proctoscopic examination was negative.

The temperature, pulse and respirations were normal. The blood pressure was 120 systolic, 80 diastolic.

The examination of the urine was negative. The blood showed a red-cell count of 2,150,000, with a hemoglobin of 6.6 gm. and a hematocrit of 20. The white-cell count was 6400, with a normal differential. The nonprotein nitrogen was 40 mg. per 100 cc., the serum protein 6.5 gm., and the uric acid 6.6 mg. The prothrombin time was 21 seconds (normal, 18 to 20 seconds), the bleeding time 2.5 minutes, and the clotting time 10 minutes. The blood Hinton reaction was negative. A stool specimen gave a negative guaiac test. A gastrointestinal series with hourly films showed the esophagus, stomach and small bowel to be normal. A barium enema was also negative.

The patient was given three blood transfusions of 500 cc. each. On the tenth hospital day an exploratory laparotomy and appendectomy were performed. No cause of the gastrointestinal bleeding could be found. He recovered uneventfully and was discharged on the nineteenth hospital day.

Second admission (two months later). Despite the occasional passage of occult blood in the stools, the patient felt well until six days before his second admission, when he returned from a two-day hunting trip feeling "all in." After the evening meal he became nauseated but had no pain. The nausea and weakness persisted until the day of admission, when the local doctor found the blood pressure to be 80 systolic, with the diastolic pressure unobtainable. An enema on the previous day was said to have produced a grossly bloody stool. He had not vomited at any time during his illness.

Physical examination revealed a pale, anemic and weak-appearing man with no acute complaints. There was minimal deep tenderness over the cecal region. Proctoscopy was again negative.

The temperature, pulse and respirations were negative. The blood pressure was 102 systolic, 80 diastolic.

Examination of the blood revealed a hemoglobin of 5.5 gm. The white-cell count was 5000, with 73 per cent neutrophils. The urine was negative. Three stool specimens gave strongly positive guaiac tests.

A gastrointestinal series and a barium enema were entirely negative except for a hiatus hernia of the stomach measuring 2.5 cm. in diameter. On the morning of the seventh hospital day the patient vomited four times following the administration of 0.5 mg. of colchicine. The vomitus had the appearance of coffee grounds.

The patient received two 500-cc. blood transfusions. Gastroscopy and esophagoscopy were entirely negative. On the twentieth hospital day an operation was performed.

Differential Diagnosis

Dr. James A. Halsted: The tenderness to deep palpation in the abdomen may be explained by the fact that this man had been operated on for appendicitis two months before admission and might be expected to have tenderness in that region.

Do you care to show the x-ray films, Dr. Lingley?

Dr. James R. Lingley: They are negative.

Dr. Halsted: He did have a small hiatus hernia, but I imagine that it was chiefly seen by fluoroscopy.

Dr. Lingley: That is correct; the films do not add anything.

Dr. Halsted: This middle-aged man was in good health except for gout, until he suddenly had pain in the left lower quadrant and weakness. We do not know whether this was caused by a gastrointestinal hemorrhage, nor do we know what x-ray films were taken, but in view of the subsequent history we can assume that this was the first of four massive hemorrhages that he had during the course of a year. He was without any other gastrointestinal symptoms. He had four gastrointestinal x-ray examinations, all of which were negative except for a small hiatus demonstrated at the last. He also had a negative exploratory operation two months before the last admission, two negative proctoscopies and a negative gastroscopy and esophagoscopy. There is thus almost nothing to go on except symptomatology.

The physical and laboratory examinations reveal nothing other than signs of marked anemia and an elevated uric acid, which would be expected with gout. I do not know how to evaluate the pain in the left lower quadrant or the tenderness in this region noted at the first admission, but in view of the negative barium enema, negative proctoscopy and negative laparotomy I am inclined to discount it as unimportant. One thinks of diverticulitis, but such a lesion does not bleed.

There is nothing to suggest that a primary blood disorder caused the hemorrhages. We can dismiss gout as playing a role in the picture except to comment on the fact that he probably had an acute attack, although the record does not state it, at the time of the second admission because he was given colchicine. This resulted in, or rather was followed by, vomiting of coffee-grounds material. One tablet of colchicine is unlikely to produce vomiting. Acute attacks of gout occur typically in a gouty person following such upsetting episodes as an operation, a trip, a hemorrhage and an infection. So I am not surprised that he had attacks after these hemorrhages.

The first problem is to try to place the location of the hemorrhages. The stools were described as tarry on several occasions but gross blood was noted on two occasions. Blood from the colon may be dark but is rarely dark enough to be termed "tarry." Tarry stools usually mean that the bleeding is coming from the stomach or small intestine. The fact that he had grossly bloody stools also does not necessarily suggest a large-bowel lesion, since bright red blood may appear in the stools after a hemorrhage from the stomach provided intestinal motility is fast enough. He only vomited once, and the vomitus was described as coffee-grounds in appearance, which is strong evidence that the blood came from the stomach or duodenum. The possibility of multiple lesions arises. Polyposis, both of the colon and stomach, is a rare entity. In the presence of negative proctoscopic, gastroscopic and x-ray examinations it may be excluded. All in all, the evidence points to the bleeding from the stomach or small intestine.

Could this have been due to an extragastric cause, such as cirrhosis or Banti's disease? The patient was a liquor dealer, but that does not mean that he drank excessively or at all. The two recorded white-cell counts show a slight leukopenia, but in the absence of esophageal varices, which ought to be demonstrable by x-ray examination or esophagoscopy, and of splenomegaly and in the presence of a negative laparotomy I think that we can exclude cirrhosis and Banti's disease.

Duodenal ulcer is the most frequent cause of hemorrhage. It may occur without other symptoms, but if one that bleeds four times in a year, it should produce digestive symptoms. X-ray examination may be negative, although again it is unlikely to be negative four times. I do not believe that he would have been subjected to operation twice for ulcer if it was not demonstrable.

Gastritis often causes severe hemorrhage. X-ray examination is a poor method of diagnosing gastritis, so that four negative examinations do not rule it out. There was one negative gastroscopy.

This also does not rule out gastritis because we do not know when the gastroscopy was performed — how long after the hemorrhage, which he had seven days after admission. Gastritis may heal rapidly and not be demonstrable after a bleeding episode. I do not believe, however, that gastritis is the diagnosis because it is unlikely without any other symptoms and a negative gastroscopy.

We might consider such a rare condition as telangiectasia, a hereditary condition, which does occur in the stomach; but since it is associated with cutaneous and mouth lesions, which this patient did not have, I think that it can be discarded.

We come now to the hiatus hernia. A hiatus hernia may bleed, but it is generally a slow oozing. Massive bleeding does rarely occur and is usually associated with gastritis or ulceration in the mucosa of the hernia. Since there was no evidence of that by gastroscopy or esophagoscopy and since he had no other symptoms, I do not believe that that was the cause of the bleeding.

Did he have a tumor of the small intestine, which might easily have been missed by x-ray examination, such as a leiomyoma, an adenoma or a neurogenic tumor? That is a possibility but I doubt that it was the cause.

Could he have had a tumor of the stomach that was missed by all these examinations? If he had a small carcinoma, it would be extremely unlikely that he had no other symptoms except bleeding. Massive hemorrhage from carcinoma is quite unusual, particularly in a person who has had repeated hemorrhages over a long period of time.

Did he have a benign tumor of the stomach, such as a polyp or leiomyoma? Either of these tumors may be small and may ulcerate and bleed, particularly a leiomyoma, and may be missed by x-ray examination.

In view of such completely negative findings I can do no more than guess, but I shall suggest a diagnosis that is most consistent with the symptomatology given, even though it is a rare condition. I think that the symptomatology of the patient fits in best with a leiomyoma of the stomach. This tumor is often associated with repeated massive hemorrhages without any other symptoms. It must have been a small one to have been missed by x-ray examination and exploration, but for the reasons given the other usual causes of bleeding are unlikely.

DR. TRACY B. MALLORY: Dr. Benedict, have you any comment?

DR. EDWARD B. BENEDICT: I thought that on a statistical basis this was fairly likely to be a duodenal ulcer in spite of the negative examination and the negative exploratory laparotomy. Even if one sees the stomach and duodenum at operation one cannot always see the lesion. I believed that he should have a resection on the basis that he was bleeding from the duodenum.

CLINICAL DIAGNOSIS

Gastrointestinal hemorrhage (ulcer?).

DR. HALSTED'S DIAGNOSES

Leiomyoma of stomach.
Gout.

ANATOMICAL DIAGNOSES

Gastric ulcer, acute.
Gastritis, acute.

PATHOLOGICAL DISCUSSION

DR. ARTHUR W. ALLEN: I explored this man two or three months before his ultimate operation. At that time I went over his entire gastrointestinal tract as carefully as I could, having in mind particularly that this might have been a small-bowel lesion. Early tumors of the small intestines are extremely difficult to pick up in the x-ray examination, even with the so-called "small-bowel enema." The exploration was absolutely negative. My own reaction about it was that if he had had a duodenal ulcer that had caused three bouts of hemorrhage we should have found some indication of scarring, even if we could not feel a crater. Since the duodenum never looks normal after there has been an ulcer that has bled massively, one always has some lead that the disease is in that region. But this duodenum was absolutely normal. There was nothing abnormal that I could palpate throughout the length of the small bowel. I was not so happy about palpation of the colon because the large bowel was not completely empty at the time of exploration. But even when the colon is empty, it is sometimes difficult to palpate a polyp. On the other hand, satisfactory barium enemas had been performed, and the roentgenologists can diagnose polyps by that method quite accurately. So I did nothing except the exploration and appendectomy, being still in doubt about the source of his bleeding.

We have a certain number of patients who bleed massively from the gastrointestinal tract in whom we cannot find the cause or source of hemorrhage. Of course the majority of them have a definite lesion that can be so demonstrated by our various examinations that we are quite sure of the diagnosis. Then there is a small group that have lesions that we suspect as being the source of bleeding, the chief one of these being diverticulosis, although we are never quite certain about that.

The reason that this man was operated on the second time is that we thought he was going to bleed to death if we did not do something about it. We had information for the first time after gastroscopy, which caused him to have blood in the vomitus, indicating that the source of the bleeding was high. Based on the experience of just one other case that we had here a few years ago, in which all examinations except that for gastritis

were negative, we decided on subtotal gastrectomy. The first man, who was about the same age as the one under discussion today, had repeated hemorrhages and came back every three or four months exsanguinated. We finally did a subtotal gastrectomy on the basis of gastritis and found a lesion that was similar to the one discovered in today's case, which Dr. Mallory will describe.

DR. CLAUDE E. WELCH: The second operation was done after the decision had been made that we could not stand idly by; it was a matter of getting the patient into shape and doing, let us say, a blind subtotal gastric resection. The only important findings at operation were a few adhesions in the lesser omental sac, just behind the pylorus. Everything else was so negative that I thought Dr. Castleman should come to the operating room himself to be sure that we did not make any holes in the specimen.

DR. MALLORY: Dr. Castleman, will you tell us what you found?

DR. BENJAMIN CASTLEMAN: In the central portion of the stomach there was a small but definite superficial ulceration surrounded by a smaller and even more superficial erosion. There was no evidence at that time that the patient was still bleeding. As soon as I told Dr. Welch that I had found something he was delighted. He was afraid that the stomach would prove to be normal. The fact that we did find an erosion and a superficial ulceration satisfied him.

DR. MALLORY: The sections from the stomach showed a moderately severe gastritis well down in the pyloric area, where Dr. Benedict might not have been able to see it. In this area there was a very shallow erosion. One could just barely call it an ulcer; still it was quite active, with beginning healing at the margins. It is reasonable to say that that was the cause of the hemorrhage.

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GAMMA GLOBULIN IN ACUTE HEPATITIS

In the October 4, 1945, issue of the *Journal*, the Massachusetts Department of Public Health announced the initiation of a program for the provision of blood and blood derivatives without cost to the citizens of Massachusetts. Among the blood derivatives that it hopes to provide is gamma globulin, which is prepared in such a manner as to contain in a concentrated form most of the antibodies that are normally found in human plasma. A number of studies by workers in different localities have been made in collaboration with Dr. Edwin J. Cohn and his associates in attempts to determine the prophylactic and curative value of gamma globulin in various infections. The results of several such studies with respect to infectious hepatitis, formerly called "catarrhal jaundice," have already become available.

Stokes and Neefe[1] tested the prophylactic value of intramuscular injections of gamma globulin during an epidemic of infectious hepatitis in a summer camp for boys and girls. There were 331 children who had had no signs of disease when they began their study, and 53 of these were injected with gamma globulin, using an arbitrary dose of 0.15 cc. per pound of body weight. Among those who received these injections, only 3 developed jaundice, but 8 additional children developed symptoms and laboratory evidence of hepatitis without overt jaundice. The icterus in the 3 cases was visible only in the scleras and not in the skin. Of the 278 children who did not receive globulin injections, 125 developed jaundice and 60 had evidence of hepatitis without jaundice. Thus, the total incidence of infection among the globulin recipients was 21 per cent, as compared with 67 per cent among the controls, a difference that is statistically significant. The average duration of icterus was about five days in the injected cases, and more than fourteen days in the control cases. Furthermore, the onset of hepatitis in the 11 patients who received gamma globulin occurred in every case during the first ten days following injection, whereas cases continued to appear among the controls for thirty-two days.

On the basis of this report, field studies on the prevention of hepatitis were conducted during an outbreak of this disease in a bombardment group based in the Mediterranean Theater of Operations during the fall and winter of 1944–1945.[2] The dose of gamma globulin chosen for this study was 10 cc., which was found to be the largest amount that could be injected without affecting the full-duty status of the men. Globulin was given to members of two squadrons and to a headquarters group, whereas those belonging to two other squadrons served as controls. Each of the squadrons had about 500 men, and all were quartered on the same field. Among the injected squadrons there occurred 3 cases of hepatitis with jaundice. Two of these cases occurred in persons who, for some reason or other, had not received the globulin injections. The third developed jaundice only of the scleras, and this began

9 days after the injection. In the same period, 25 cases of hepatitis with jaundice occurred in the control squadrons. Previous to the time of the globulin injections, there had been 95 cases in the injected groups and 116 cases in the control groups.

A second study was undertaken in three groups of ground forces among which an epidemic of hepatitis had already started. Injections of 10 cc. of gamma globulin were given to varying proportions of the strengths of these three groups — 40 per cent of one, 10 per cent of another and 25 per cent of the third. The groups consisted of 1089, 9101 and 1868 men, and they were followed for twelve, seven and five weeks, respectively, after the injections. A total of 9 cases of jaundice developed in the injected persons, an incidence of 0.5 per cent, as compared with 335 cases, or an incidence of 3.3 per cent, among the controls.

Havens and Paul[3] also conducted a study on the prevention of infectious hepatitis during an epidemic in a Catholic home for children in New Haven, Connecticut. Doses ranging from 5 to 10 cc. of gamma globulin were used, depending on the weight, the average being 0.08 cc. per pound. Gamma globulin was given to 97 children, whereas 155 served as controls. Jaundice occurred in 2 of the inoculated children, and in 36 of the controls. There were 6 additional cases of hepatitis without jaundice in the protected group, and 17 among the controls. Thus, 8 per cent of the inoculated group came down with the disease, as compared with 34 per cent of the controls, and the incidence of cases of overt jaundice was more than ten times as frequent among the latter.

All these results indicate quite definitely that gamma globulin given to susceptible persons after exposure to or during the incubation period of infectious (epidemic) hepatitis usually prevents the disease, and that the disease is attenuated in most of those who become infected after inoculation. The passive immunity seems to last at least six or eight weeks.

Studies with gamma globulin in measles had suggested that it was of value in lessening the severity and in shortening the course of that disease if given soon after the onset of symptoms. In view of the long illness and convalescence in cases of infectious hepatitis, it seemed worth while to determine whether gamma globulin had a similar attenuating effect in this disease. A study of this aspect was made during an outbreak of infectious hepatitis in the air forces in the Mediterranean Theater of Operations.[4] Two hundred and seventy-eight patients admitted to the hospital with a tentative diagnosis of infectious hepatitis were studied. Gamma globulin was given intramuscularly in doses of 0.3 cc. per pound of body weight to alternate patients. No significant difference in the severity or duration of jaundice or in the duration of the positive methylene blue test in the urine was observed in the two groups of cases. This study suggests that there is no attenuating effect of gamma globulin when given in these doses early in the course of infectious hepatitis.

Additional studies have been undertaken to determine whether gamma globulin also serves to prevent so-called "homologous serum jaundice." One such study was undertaken in a large general Army hospital in continental United States after 100 cases of jaundice had been observed among battle casualties who had received transfusions of whole blood or plasma.[5] Casualties who had been wounded for less than four months and had received injections of various blood products but had not developed symptoms of hepatitis were chosen for this study. Alternate cases were given 10 cc. of globulin on admission to the hospital, and this was repeated after one month. There were 384 cases in each group, and hepatitis with jaundice developed in 2.9 per cent of the globulin recipients, as compared with 11.5 per cent of the controls. In more than half the cases that occurred in the globulin recipients, the onset of symptoms of hepatitis occurred less than a week after globulin had been given. By contrast, more than three quarters of the cases that occurred among the controls began more than one week after admission. The results of this study suggest that the early administration of serum globulin was effective in preventing hepatitis in these cases. In an addendum to this report, however, mention is made of a similar study conducted at another large general Army hospital. In that study a single injection of globulin was used, and it seemed to have no effect on the incidence of homologous serum jaundice

among battle casualties who had received transfusions of blood or plasma. Reference is also made to an experimental study that indicated that one preparation of gamma globulin had no neutralizing antibodies for one causative agent of serum hepatitis. The exact basis for the discrepancies has not yet been clarified. Thus, the prophylactic value of gamma globulin in the prevention of homologous serum jaundice remains uncertain.

Gamma globulin apparently has a definite place in the prophylaxis of infectious or epidemic hepatitis, that is, so-called "catarrhal jaundice." It is hoped that the Massachusetts program will receive enthusiastic support so that provision of gamma globulin for that purpose and for its use in other conditions in which it has proved effective will be possible. It should be borne in mind, however, that gamma globulin is not effective in modifying infectious hepatitis if given after symptoms have appeared and that at the present time its effectiveness in the prevention of homologous serum jaundice is not definitely proved.

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MOTORCADE

THE most contumacious lover of living horseflesh must admit, after the passage of these fifty-odd years, that the automobile has come to stay. As the horse was to the cowboy, the circuit rider and the doctor of yesterday, so is the automobile today to the doctor, the salesman, the baker and the candlestick maker, multiplied a million times. The automobile is here in our outmoded town and city streets; we cannot ignore it; we cannot make it disappear by banning its parking or, if it is parked, by plastering it with tickets.

It is to these millions a vital part of their bread-winning capacity; the very officer who makes the stream of traffic halt at his command, succeeding where King Canute failed, or who occupies his time chalking the tires of potential overtime parkers, mounts his own chariot, his duty done, and drives away like Jehu the son of Jehoshaphat, or Mr. Toad of Toad Hall. His hunting over he joins the exodus, immune, perhaps, from becoming one of the hunted.

It cannot be doubted that many of our citizens, commonly respected and accepted as decent members of society, legally married and the parents of small children, still have two sides to their characters — the Dr. Jekyll side, using their reputations as a sort of guarantee of irreproachable conduct, and the Mr. Hyde side, the latter manifesting itself when they are behind the wheels of moving automobiles. There is a hypnosis to swift vehicular travel that affects us all somewhat as it did the reptilian hero of *The Wind in the Willows*. It sets us on edge; it removes our sense of propriety and puts us in open conflict with all our fellows, even if it does not turn us into the scoundrels that the law, afoot or awheel, seems to consider all human beings awheel to be. All scoundrels, it is true, may at times drive motor cars; it does not follow that all drivers of motor vehicles are to be considered scoundrels until proved otherwise.

The physician, parenthetically, setting himself aside from other individuals and classes of men, although not above them, feels that there is a particular urgency about his use of the automobile; that to serve the public best he should be in a position to travel in his car with reasonable dispatch to minister to his patients, to visit his hospital or to reach his office, and to leave his car in legal, if not in physical, safety when he has arrived at any of these destinations.

Up to the present time the efforts of our traffic authorities, although zealous, appear to the conscientious driver to have been at times somewhat shortsighted. They have been designed primarily to speed up traffic flow with only secondary thought being given to the terminals and way stations at which that traffic must stop. Insufficient consideration is given to the facts that every driver is theoretically on some legitimate errand — the term "pleasure car" being now an outdated misnomer — and that to discharge his mission he must bring his

space-occupying transport somewhere to a halt, and there leave it for a period of time.

To solve urban traffic problems — and for Boston the proposed garage under the Common would be only a partial answer — convenient scattered terminals must be furnished in a suitable ratio to the volume of traffic. Levees along a river to confine and hasten the flow of water do not constitute effective flood control. What must be provided are extra basins into which the flood waters can be diverted and allowed to settle. Similar areas for automobiles are more important for what appears to be our immediate mechanical future than are wide sidewalks, grassy malls or extra traffic officers with even louder whistles and more pieces of chalk.

MASSACHUSETTS MEDICAL SOCIETY

RESOLUTION CONCERNING REVIEW LECTURE COURSE

The following resolution was unanimously adopted by those physicians attending the last session of the Review Lecture Course on May 15:

RESOLVED that we, the physicians who have attended the Review Lecture Course for former medical officers and practitioners, presented by the Massachusetts Medical Society and the Department of Public Health, Commonwealth of Massachusetts, do hereby express our thanks and deep appreciation to the officers of the Massachusetts Medical Society, the officials of the Massachusetts Department of Public Health, the members of the various committees concerned, the chairmen, the lecturers and all others who so ably participated in planning and carrying through to a most successful conclusion the excellent program that was made available to us.

This program not only met the requirements of those recently returned from active service but also those of the busy practitioners who have been unable to attend many medical meetings during the war years.

DEATHS

ATWATER — James B. Atwater, M.D., of Westfield, died May 3. He was in his eighty-eighth year.

Dr. Atwater received his degree from the New York University Medical College in 1882. For thirty-seven years he was chief of staff at Noble Hospital, and since his retirement in 1934 chief-emeritus of that institution. He was a member of the American College of Surgeons, the American Academy of Medicine of New York, the New England Association of Railroad Surgeons and the Springfield Academy of Medicine, and a fellow of the American Medical Association.

Two sons, a sister, two grandsons and a granddaughter survive.

AYER — Thomas H. Ayer, M.D., of Westboro, died May 16. He was in his eighty-first year.

Dr. Ayer received his degree from the Bowdoin Medical School in 1893. He was a fellow of the American Medical Association. He retired in 1934.

EVANS — Miner H. A. Evans, M.D., of Wellesley Hills, died May 5. He was in his sixty-sixth year.

Dr. Evans received his degree from Harvard Medical School in 1902. He became assistant physician at the Danvers State Hospital and later became associated with the Adams Nervine Asylum. He established a private practice in Roxbury in 1906 and was also a member of the staffs of the neurologic services of the Boston Dispensary and the Carney Hospital. Later, he became associated with the Dorchester Free Dispensary, the Boston Psychopathic Hospital and the Boston City Hospital. At the time of his death, he was consulting physician in neurology and psychiatry at the Quincy City Hospital and visiting physician in neurology at the Boston City Hospital. He graduated in 1915 from the Boston University Law School and was later admitted to the Massachusetts and the United States bars, having been a consultant in many criminal trials. He was a member of the American Psychiatric Association, New England Society of Psychiatry and Neurology, Massachusetts Society of Psychiatry and Boston Society of Psychiatry and Neurology and a fellow of the American Medical Association.

His widow and two daughters survive.

MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH

CONSULTATION CLINICS FOR CRIPPLED CHILDREN IN MASSACHUSETTS UNDER THE PROVISIONS OF THE SOCIAL SECURITY ACT

CLINIC	DATE	CLINIC CONSULTANT
Salem	June 3	Paul W. Hugenberger
Haverhill	June 5	William T. Green
Lowell	June 7	Albert H. Brewster
Greenfield	June 10	Charles L. Sturdevant
Gardner (Worcester Sub-clinic)	June 11	John W. O'Meara
Brockton	June 13	George W. Van Gorder
Pittsfield	June 17	Frank A. Slowick
Springfield	June 18	Garry deN. Hough, Jr.
Worcester	June 21	John W. O'Meara
Fall River	June 24	David S. Grice
Hyannis	June 25	Paul L. Norton

Physicians referring new patients to clinic should get in touch with the District Health Officer to make appointments.

CORRESPONDENCE

LOCAL INJECTION OF PENICILLIN

To the Editor: The following observations are offered in regard to the article "The Regional Injection of Penicillin in Local Infections," by Rose and Hurwitz in the February 28 issue of the *Journal*.

Injections of penicillin in saline are ordinarily painful. Given by the method described, in which the authors recommend "injecting slowly ahead of the needle, and progressing toward the center of infection," the injections may be severely painful, even if one avoids inserting the needle into the inflammatory area.

In my experience, this pain can be minimized by inserting the injection needle through a small skin wheal of 1 per cent procaine, thrusting the needle into the depth desired and then making the injection of penicillin as the needle is withdrawn. In our hands, this method has been effective in the treatment of large furuncles without incision. I have not added procaine to the penicillin solution itself. According to Hirsh and Dowling (*Am. J. M. Sc.* **210**:435, 1945), however, small amounts of procaine would have no detrimental effect on the action of the penicillin.

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United States Marine Hospital
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(*Notices on page xv*)